The Foundry

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ADVERTISING PAGES REMOVED

DOWN INTO THE

Goes the Deming

AT the left — a modern successor of the old oaken bucket is furnishing sparkling clear water to the Ohio Hotel in Youngstown, Ohio.

Many hotels, sanitariums, industrial plants and other large users of water find it costs less to pump their own than to buy water.

The installation shown is a 30-stage impeller turbine. Bowls are cast separately and bolted together. Impeller shaft turned by motor at top. Number of impeller stages, from one up, depends on lift required. Made in various sizes. Delivery 25 gallons to 3500 gallons per minute.

The Deming Company, of Salem, Ohio, manufacture power and hand pumps of every kind and use Linoil for all of their cored castings.

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it saves money in
You too make bet

THE WERNER G.

The Foundry

Schools for Foundrymen Open in September

EXCEPTIONAL opportunities for self advancement in the foundry industry abound as the various local associations and A. F. A. chapters get under way with technical programs in September. Undoubtedly, active participation in the work of local groups and those national associations related in some degree to the foundry industry provides the best possible training in present day knowledge of castings manufacture.

The value of association work was outlined exceptionally well by John A. Capp, General Electric Co., Schenectady, N. Y., recently, in responding to the awarding of an honorary membership in the American Society for Testing Materials. While Mr. Capp was referring particularly to the A. S. T. M., we believe his philosophy, expressed in part in the following paragraphs, is equally applicable to any group organized to further the progress of industry.

It has occurred to me more than once that those of us privileged to partake actively in affairs of the society really are going through an advanced course in engineering.

The first is a course in materials of engineering. Nowhere is there available to the participant the vast fund of information, the technical knowledge of materials, that is available to the man who gives and takes in committee activities. That information is not published in textbooks. Much of it does not appear in the *Proceedings*. It is the result of personal contact in giving as well as taking in committee activities.

That is an important course, but more important is the opportunity of taking a course in human engineering, in which we learn to deal with others in a human way. We might think of the strong opinions which the engineer is liable to form, of undue adherence to those opinions, and of the failure to realize the opinions of others may be worth just as much, if not more.

Nowhere does that sort of give and take, as a necessity, appear as it does to the student of human engineering in A. S. T. M. committee activities. The man who goes to any committee in the right spirit nearly always can accomplish anything, perhaps not what he wants, but what he ought to have. There may be a big difference.

The most interesting part of these two courses is the fact there is no formal curriculum, there are no professors, no examinations except the test of endurance, no degrees awarded, no diplomas, nor, in fact, do we graduate. There can be no more worth while job for the young engineer than to enroll in these two courses.

There is a lot ahead for the man who does. He can serve the society by helping it co-operatively, but if nothing more, a tremendous gain to himself must result.

School in the foundry industry starts again in September.

Fads and Castings

WHEN foundries are busy and at times unable to meet delivery demands of customers, market research usually is forgotten. Little time is spent in exploring new fields, in investigating trends in consumer demand which may have a direct bearing on extending the use of cast products.

Fads and fancies of the buying public often present interesting opportunities. As an example, witness the spreading belief in the healthful properties of raw vegetable juices. Numerous doctors are said to recommend this form of diet. Patients who have tried and have been benefited are glad to broadcast the news. As a result more people are making cocktails from the juices of carrots, celery, beets, cabbage and other vegetables.

When it comes to a question of developing a device to extract juice from vegetables, the foundry has the inside track. Various types of juicers are in use, but every one is based on the design of the old fashioned meat grinder. Most important in the present instance, these juicers are constructed almost entirely of castings. Retail selling prices indicate that it is a profitable business.

Frank G. Steinebach
Editor

Malleable Foundry Maintains

Fig. 1—Coremaker's benches are located at each end of the four corners of the entrance or uptake shaft. The exit end at which cores are removed can be seen in the distance

By EDWIN BREMER

SYNTHETIC sand used in the Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., is based upon the core sand. As might be expected, considerable care is exercised in its selection and treatment prior to use. The sand not only must provide first class, serviceable cores, but also must possess a grain size and distribution which will serve satisfactorily as a molding sand base. A bank sand is used, which is all dried previous to use in the core room.

Sand Dried in Gas Fired Kiln

Drying of the sand is accomplished in a specially designed, rotary horizontal kiln 62 feet long and 3 feet in diameter. It is gas-fired, has a capacity of 12-tons per hour and an overall efficiency of 82 per cent. The remarkable feature of the dryer is that the moisture content of the sand is reduced to 0.10 per cent, and the sand emerges at a temperature ranging from 70 to 80 degrees Fahr. Design of the kiln is such that it is divided into two sections termed the dryer which is about 37 feet long and the cooler which is about 25 feet long. The kiln is the counterflow type in which the sand and the heating and cooling gases flow in opposite directions.

As indicated in the sketch shown in Fig. 4, the shell of the kiln contains spirally located baffles which carry the sand up almost to the vertical point and then permit it to fall in a thin shower through the heating and cooling gases as the kiln slowly rotates. A circular baffle with a comparatively small central opening in relation to the kiln diameter, and attached to the shell, separates the drying and cooling sections. The heating gases are generated in a combustion chamber by a gas burner, and they pass through a tube in the center of the dryer portion of the kiln. The tube extends almost to the end of the dryer or to the baffle separating the drying and cooling sections. Consequently, the heating gases flow through the tube and back through the shell to a stack which is located at the same end as the combustion chamber.

Temperature Controlled Automatically

Similarly, at the cooling section, atmospheric air is blown in through a tube extending nearly to the baffle separating the two sections. That air doubles back between the tube and kiln shell, cooling the sand in its passage, and escaping at the same end it enters. Control of the sand drying unit is automatic, and is effected through a temperature regulating device located in the stack carrying away the heating gases. That device

Fig. 2—The largest percentage of cores made in the plant are produced on core-blowing machines similar to the three machines which can be seen in this illustration

controls the amount of heating gases generated in the combustion chamber which, through another temperature regulating device, is maintained constantly at 1400 degrees Fahr.

Stack Temperature Indicates Condition

The principle of control is based on experimental data which indicate that with a definite volume of gas at a constant temperature passing through the sand, the amount of moisture or water vapor picked up can be determined by its temperature at the exit or stack under the particular conditions of operation. This applies if the sand is not dried to the minimum point in this first step, but only to where it contains about 1½ per cent moisture. The stack temperature to provide sand of that low water content ranges from between 145 and 190 degrees Fahr. depending upon the relative humidity of the atmosphere.

If the entering sand contains more moisture than the usual content, the heating gases become more saturated, and that is indicated by higher temperature at the exit end. Consequently, the volume of heated gases entering at constant temperature must be increased sufficiently to counteract the rise in temperature at the stack, and bring it back to the predetermined point. Of course, with an increase in volume of gases, the fuel input increases, but the temperature in the combustion chamber remains constant.

As previously mentioned, the drying chamber proper is baffled so that its heat does not enter the adjoining cooling section. However, the sand as might be judged, has picked up a considerable quantity of heat. The heat retained is more than sufficient to reduce the moisture content from the 1½ per cent which the sand contains upon leaving the dryer section to the desired limit of 0.10 per cent. Consequently, atmospheric air is blown through the sand in the cooler to reduce the temperature of the sand to a point where it can be handled without trouble around 70 to 80 degrees. The air blown in also removes any fines that might cause difficulty in later applications.

Slant Improves Effectiveness of Screen

Sand emerging from the rotary drying kiln drops into an elevator boot and then onto an elevator belt which transports it up to a vibrating screen where any roots and other coarse, extraneous materials are removed. The vibrating screen is 40-mesh, mounted at an angle so that it has the effectiveness of a 60-mesh screen. From the screen the sand is conveyed on belts to storage

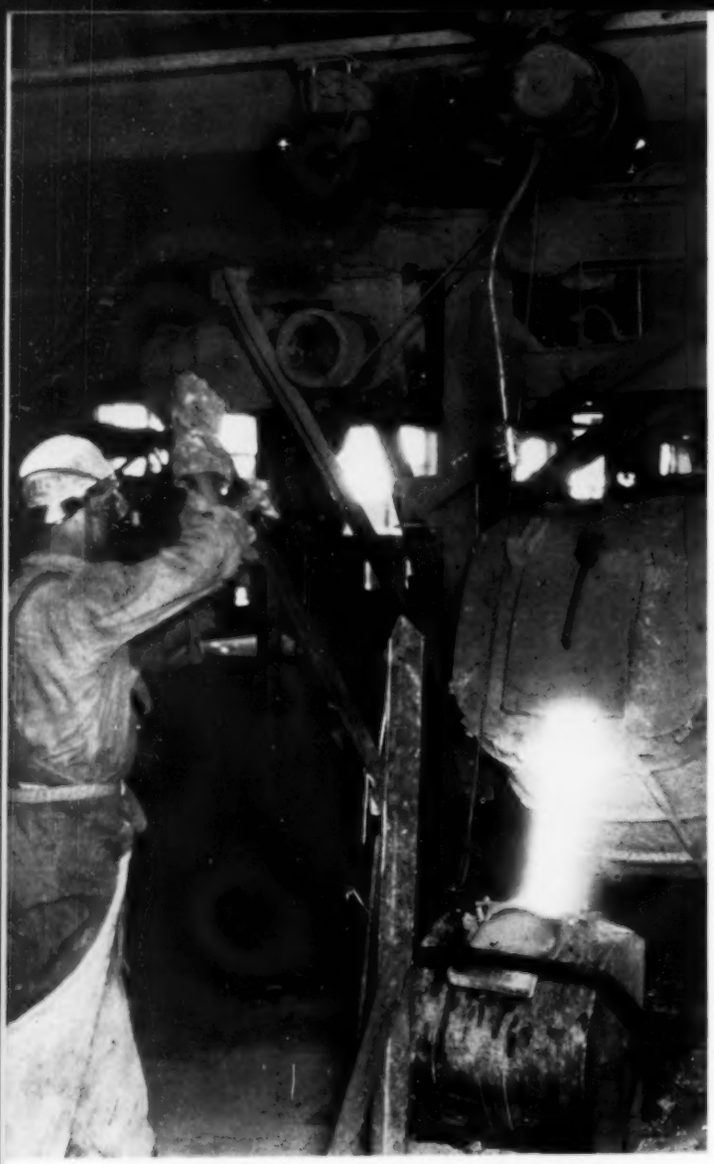


Fig. 3—Filling a pouring ladle from the transfer ladle. As may be observed all ladles are covered to maintain low temperature losses

tanks or hoppers with a capacity of 500 tons. From the storage hoppers the sand is dumped into a weighing lorry equipped with a photocell which provides automatic weighing. The lorry travels over three sand mixing units where its contents are unloaded into whichever is empty.

Several different core mixtures are employed, but they all contain varying amounts of flour, core oil and water. The flour is added by weighing while the oil and water are measured by meters which are graduated in pounds. After the various ingredients are mixed for a suitable time, the mixer gate is opened and the prepared sand falls on a conveyor belt which transports the sand to the core department. A remote control system permits the core sand to be discharged into any one section of an 8-compartment storage hopper.

From that hopper the sand is conveyed by electric trucks to the various coremaking stations. While some cores are made on the bench, approximately 95 per cent are made on various types of coremaking machines and core blowers. At the present time, approximately 75 per cent of all cores are made on core blowers similar to those shown in Fig. 2. Core sand used at the Saginaw Malleable Iron division is subjected to a very exacting control in that the moisture content is maintained within plus or minus 0.05 per cent of the desired point while the green compressive strength is held within plus or minus 0.05-pound.

That control is maintained through hourly testing of every type of core sand mixture for moisture and green compressive strength. Twice a day determinations are made of the baked tensile strength, and the baked permeability. Once a day grain distribution tests are made on the raw dry sand from the storage bins. Each carload of flour purchased is sampled by quartering, and a portion of the resulting sample is mixed with a standard sand in the laboratory. The batch thus made up is tested for green strength, and it must meet requirements based on previous experimental and practical results. The same procedure is followed with each tank carload of core oil.

Cores are baked in several batch-type, recirculating ovens, and in one vertical, continuous type oven which was designed by the firm's engineers after long and careful experimental work. Numerous advantages claimed for the oven which is partially shown in Fig. 1, include small floor space required, uniform and rapid baking with elimination of any burning, increase of 40 per cent in core production due to elimination of waiting for racks, etc., low fuel consumption of 600,000 B.t.u. per ton of cores, saving in core oil, elimination of considerable trucking and elimination of fumes, smoke and gases in the core room.

The type of cores baked in the oven are differential housing cores weighing 18 pounds which have a heavy body surmounted by a small (*Please turn to page* 69)

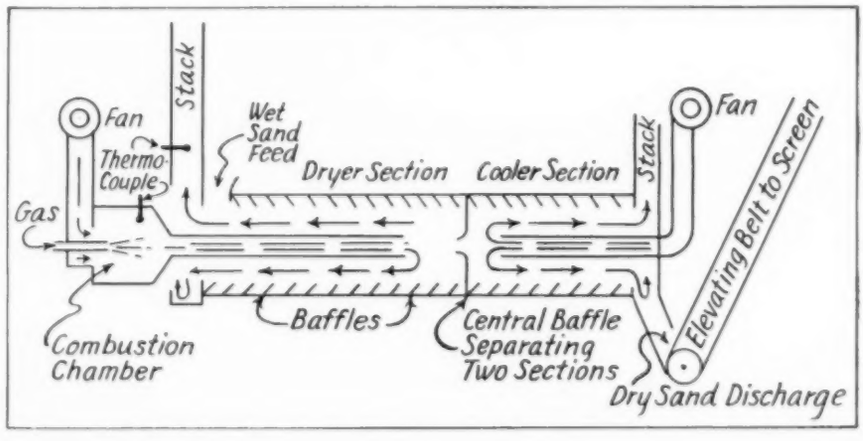
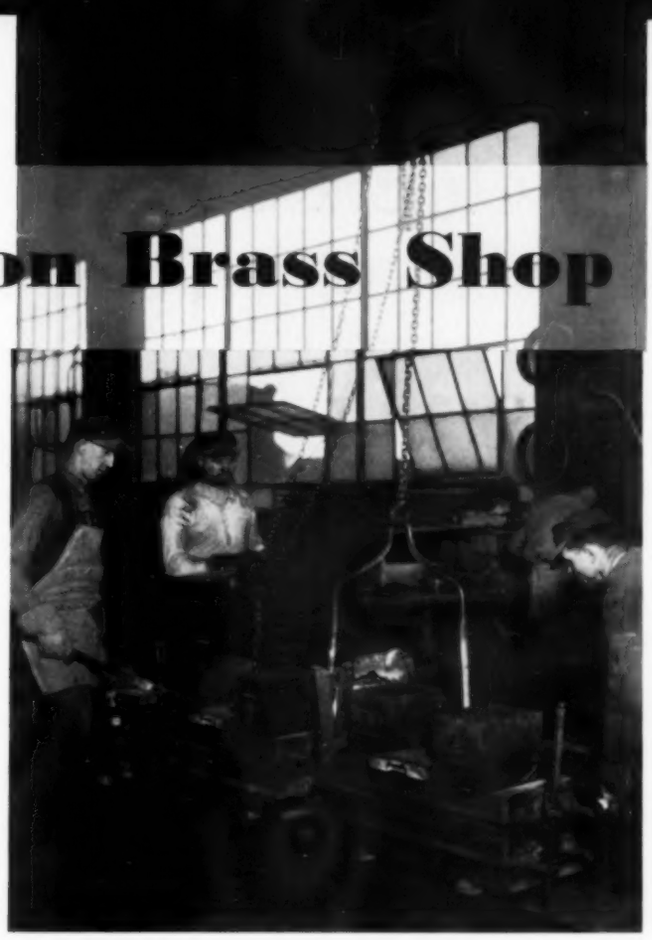


Fig. 4 — Diagrammatic sketch of the continuous, automatically operated, sand drying kiln indicating the location of various features

Hints on Brass Shop Practice



By N. K. B. PATCH

MANY nonferrous castings are of such importance, either from the standpoint of urgent demand or from high cost, that it is advisable to take no chances on blows or troubles resulting from blowing of the mold or core. Consequently, these castings are made in dry sand molds. The mold should be rammed carefully, the pattern carefully surfaced with fine sand, backed with a little coarser sand and back of that coarser material, such as gravel or coke. Some material that will support the load but will be free venting and allow the steam and gases to pass off during the drying period, without entering the surface of the mold in the slightest degree should be used. The mold face should be washed carefully with a good grade of graphite or silica before the mold goes into the baking oven where it is dried at a temperature of about 500 degrees Fahr. The temperature should not be raised rapidly to this point. Gradual increase in the temperature of the mold insures gradual evaporation of the moisture and, consequently, minimum damage. Long, slow heating is much to be preferred to rapid drying at an elevated temperature. The mold should be closed and poured promptly before it has a chance to cool too much and thus reabsorb moisture from the air.

Defects Due To Weather Conditions

Many dry sand molds have been blamed for bad castings when in reality the molds were all right. They were poured on a rainy day and the molds were allowed to cool down to a point where they reabsorbed moisture and this moisture caused the trouble. Dry sand molds should not be painted or patched with moist materials after they are dried, since this means that they are no longer dry sand molds in the spot where such moisture has been added. Sand in dry sand molds should be bonded with some form of bond just as cores are bonded. The kind of bond depends upon the preference of the foundry foreman, or the bond most economical in the district. Skin drying molds for nonferrous metals sometimes is resorted to with success, but it is a precarious practice. Some parts of the mold are dryer than others and below that dry skin there always is lurking danger of blows from heating of the moisture. A completely dried mold is much to be preferred.

Apply Smoke To Mold Face

For many castings of ornamental appearance in the red brasses, green sand molds frequently are smoked. The mold face is covered with a thin layer of lamp black or carbon. Formerly this was produced by burning resin where the smoke would deposit a black coating on the mold face. Today an acetylene torch is employed. An insufficient amount of oxygen to completely burn the acetylene results in a smoky flame which deposits the necessary amount of carbon.

Some molds are improved by shaking a flour bag over them. The flour burns upon the entrance of hot metal into the mold cavity and forms a thin layer of smoke of burning gases (*Please turn to page* 72)

Good Cores Depend Many

This is the first of a series of articles abstracted from a paper presented by the author at the fifth annual foundry conference held at Lansing, Mich., [illegible] sponsored by the A. F. A. in co-operation with the Detroit chapter and Michigan State College.

CORE making practice in this country has improved rapidly in recent years in response to the demands on the foundry industry for increasingly rigid tolerances on quality and conformance to dimensions of castings. Progress has been made possible as much by improvement in core making materials and equipment as by the development of better technique of core making and testing. To this progress, therefore, supplier and manufacturer, technician and practical foundryman alike have contributed.

Specific properties and usefulness of a core are the result not only of materials used in its making, but also of the means used to mix the materials, the equipment used to make and bake it, the conditions of baking and storing. Likewise, the selection of the raw materials and their proportion must take into account all of these factors and also envision the behavior and funetioning of the core in the mold. Superimposed on these considerations are the economic factors of ultimate casting costs. No discussion of modern core making is complete without consideration of these factors.

Outlines Principal Core Characteristics

A core is an aggregate of inert material possessing a degree of porosity, whose surfaces are bonded to a controlled mechanical strength sufficient to assemble this aggregate without breakage in making internal or external portions of castings in the mold. These cores may be either baked in their entirety, or made of green or dry sand, or a combination of green and baked core material; and made strong enough to support themselves or supported on an internal arbor.

The function of the core may be to form internal cavities surrounded by metal; to make it possible to draw some portion of the external surface of a casting from the sand which naturally would not permit this; or to strengthen or improve a particular inner or outer surface because of its special properties. In general it is true that a core must be vented to the outside of the mold or its gases vented through the mold itself, but occasionally it is true, as in certain radiator practice, that the core itself, vented to the outside, serves the function of venting the mold.

To serve usefully, a core must be strong enough in the process of preparation to retain its form without de-

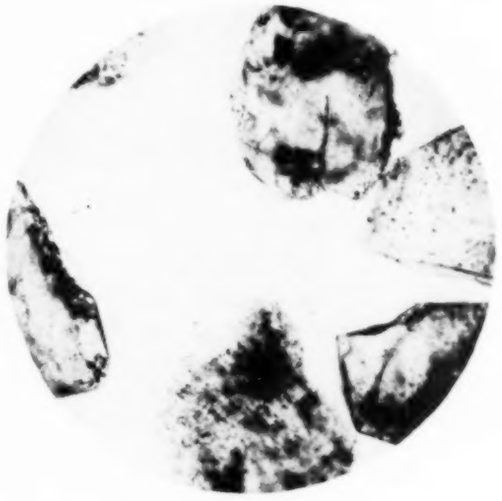


Fig. 1—Crushed stone sand grains show sharp concoidal fracture and evidence of internal cleavage planes

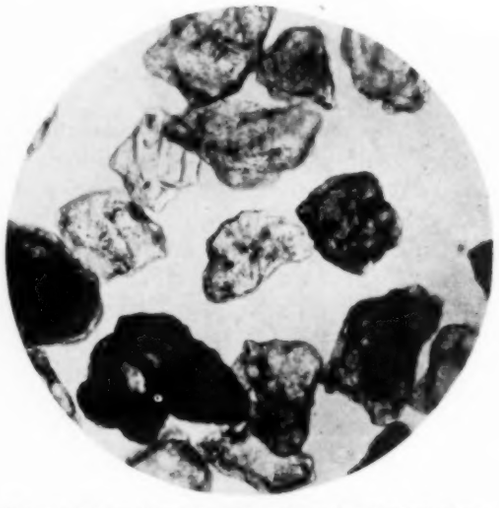


Fig. 2—River deposit grains show laminated structures and jagged edges resulting from frost. Dark areas represent impurities

Upon Knowledge of Factors

By R. E. APTEKAR
American Brake Shoe & Foundry Co., New York

formation in handling and baking; and, after baking or drying, must be sufficiently strong to resist erosion and deformation by metal during the filling of the mold. To make a true form for the casting, the sand must have the minimum [illegible] contraction and expansion.

The core must have sufficient [illegible] gas forming materials after [illegible] prevent excess gas from entering the metal, and the metal must remain quiet in contact with the core during pouring and solidification. On the other hand, the core must disintegrate following initial solidification to minimize strains on the casting and to make its removal from the casting easy during shaking-out.

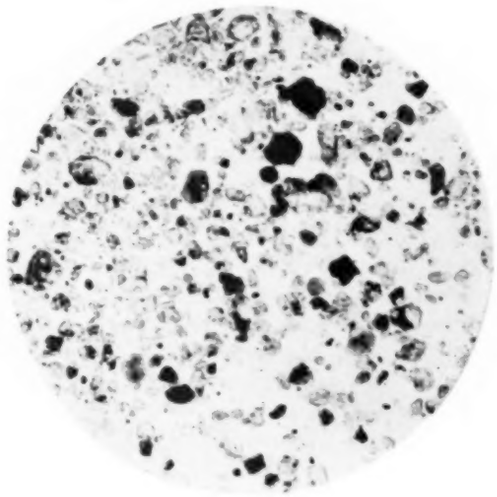


Fig. 3—Windblown deposit. Dark areas represent impurities. Pure grains are transparent

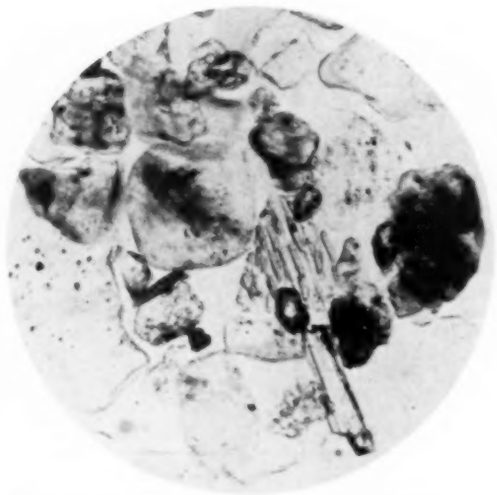


Fig. 4—Glacial lake deposit. Same base material as in Fig. 2 with edges worn rounded and smooth. Gouges are glacial scratches

Silica sand is by far the most widely used base material for cores. In actual foundry practice, there is a wide range in the sands used as to their purity, structure, grain size and distribution, and refractoriness. These sands occur in natural deposits in many parts of the country, either as surface deposits such as dunes and beaches, under water deposits such as river, lake and seashore bottoms, or as subsurface deposits of previous geologic formations. In all cases, sands are the residue of breaking up of rock structures by natural agencies of erosion, ice, frost, wind, and water.

Compare Sands from Various Sources

In general, the degree of purity of these materials is the result of their geologic history and preparation. Sea deposited sands along beaches are of a higher purity than river or wind deposits. Their grain structure is likely to be oval to subangular and their grain distribu tion as naturally found is irregular and ungraded. River sands, on the other hand, because of their recent origin are likely to be impure and irregular in structure. Their grain distribution, on the other hand, is very likely to be quite uniform as to size.

Glacial sands tend to have flat, scratched surfaces and are graded almost as accurately as river sands, when found at the edge of advancing glaciers and river and lake beds; not, however, when occurring in drumlins, or monadnocks, or in retreating glacier paths. Windblown sands usually are small in size, accurately graded, but impure, except in sand dunes of original beach surface deposits.

The Middlewest, and especially the Great Lakes region, is fortunate in possessing a large variety of core sands of glacier origin. In the Great Lakes district, these are in general clean and well graded, possessing rounded grains of 92 to 95 per cent silica content. Such sands are the Muskegon, Manistee, Port Crescent, and similar sands. There are also in this district a number of bank

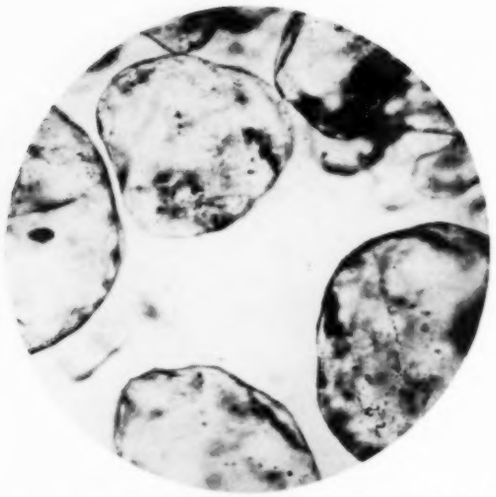


Fig. 5—Ocean washed deposit. Grains rounded due to wave action, and pitted by chemical attack of sea water

sands of similar origin and almost equal purity in the southern Michigan and northern Indiana districts.

The most unusual deposit of silica sand occurs in Illinois, known as the St. Peters deposit in the Ottawa district. When washed of its slight surface impurities, this material contains 99.5 per cent plus silica, is nearly perfectly rounded in shape, solid in structure, and uniform in grain. Somewhat similar deposits occur throughout the Mississippi valley dating to the geologic time when the Gulf of Mexico extended as far north as Minnesota.

The northeastern seaboard is distinguished for many deposits of high grade silica sand, particularly southern New Jersey and the Providence district. Both of these sands are rounded to subangular in form, the Jersey sands occurring in subsurface deposits infiltrated with small quantities of clay which makes it necessary that these materials be washed and incidentally graded before use.

A number of districts in Pennsylvania have silica rock, chemically deposited, which are crushed to make sands of extreme purity and well graded to size. The structure of these sands is sharply angular. Similar deposits occur in Ohio, Virginia, California, Tennessee, and Nevada, but the purity of California and Nevada is not as high. Progress has been made in the last few years in the grading, cleaning and preparation of these sands, so that today a specific sand for any definite purpose readily is available. The sand is quite uniform as to cleanliness, grading and distribution. Table I gives a number of representative sands available today and Figs. 1 to 5 illustrate a few.

Based on the origin of sand as outlined, this material varies in shape, grain structure, and relative surface, in addition to varying in grain size and distribution. These properties effect the usefulness and ultimate properties of the core vitally.

As indicated, sand grains may either be rounded, ovoid, subangular, angular, or compound, depending on their origin and geologic history. Rounded grains in general give the highest permeability when rammed and have the least contact area between grains, and as a result have the lowest green strength, bake more easily, require the least bonding material, but tend to wash and disintegrate more rapidy than the other shape grains. On the other hand, the sharply angular grains give the least permeability, the highest green strength, require greater amount of bonding material, bake more slowly but give a more impervious core, less subject to penetration and washing.

Subject to Laminations

The other shape grains are intermediate except the compound grains which tend to break down when heat is applied on them. Fig. 6 illustrates the various types of grain contacts. The grains in any of these forms may be homogeneous in structure, or show laminations or fissures. In general, the more rounded the grain, the stronger its structure and the less likely it is to have either laminations or fissures. Highly angular grains are most subject to laminations and fissures.

The surface of the grain increases rapidly with a decrease in size as shown by Table II. Importance of this astounding increase in surface with increase in fineness is apparent in the amount of bonding material necessary to develop required strength properties, as the amount of binder thus necessary is directly proportional to the surface area of the sand grains being used.

The most commonly used (*Please turn to page* 78)

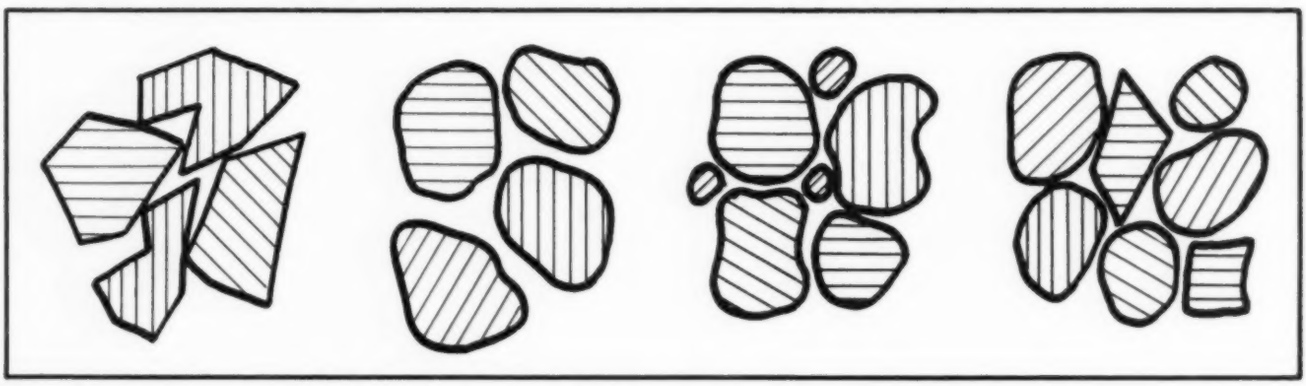


Fig. 6—Various types of grain contacts. Reading from left to right (A)—Angular grains with large number and large contact area with small pore space. Gives moderate permeability and high strength. (B)—Rounded uniform with small and few contact areas and large pore space. Gives low strength and high permeability. (C)—Mixed size round grain with numerous contact points and small pore space. Low permeability, good surface and high strength. (D)—Mixed round and angular grains with high contact area and moderate pore space. Gives high strength, medium permeability and poor surface

A Short Talk on Molding Sand

By HARRY W. DIETERT
Harry W. Dietert Co., Detroit

FOUNDRYMEN may profit considerably by studying an important production problem, namely—betterment of sand in the foundry. In many instances present day molding sand is a distinct handicap to the foundry industry. In the future the industry will be compelled to furnish castings with better finish and fewer defects. Better prepared and controlled sand will yield better castings.

Sand consists of the following three items:

Water Clay Sand Grains

Volume of these three constituents for a typical synthetic molding sand composed of 12 per cent clay and 88 per cent silica sand and carrying the average water or moisture content of approximately 5 per cent, is shown graphically in the accompanying illustration at the bottom of this page.

Water is held in the clay by absorption and on the sand grains mechanically. Excess water means mechanically held water which is converted into steam at an explosive rate. The absorbed water is converted into steam more slowly. It is the absorbed water that causes the sand to feel tempered. Water softens the clay and lubricates the grains and so affects the ramming.

Clay bond, when heated, first hardens, then contracts and finally fuses. The hardening of clay causes dry strength. Contraction or shrinkage helps to counteract expansion of silica sand grains. When the clay is present in large quantities and possesses high dry strength, the contraction will crack the mold surface. Thus, in part, it will be the cause of such casting defects as fissures and scabs.

A low sintering point causes the sand to burn on to the casting.

Sand grains of a molding sand give the sand an open structure. They expand when heated and cause mold wall fractures in compressive stresses. This, in part, results in such casting defects as rat tails and seams.

The combination of the water, clay and sand grain behavior accounts for practically all of the molding sand characteristics. The behavior of the molding sand in a mold depends upon these sand characteristics plus mold hardness, mold shape, flask and metal poured. To study the sand characteristics, the moisture test, permeability test, strength test, fineness test, sintering test, deformation and high temperature tests are most useful.

Flask Design Is a Factor

In flask design it is known that venting depends on the permeability of the sand, or the flask depth and whether the flask walls are perforated.

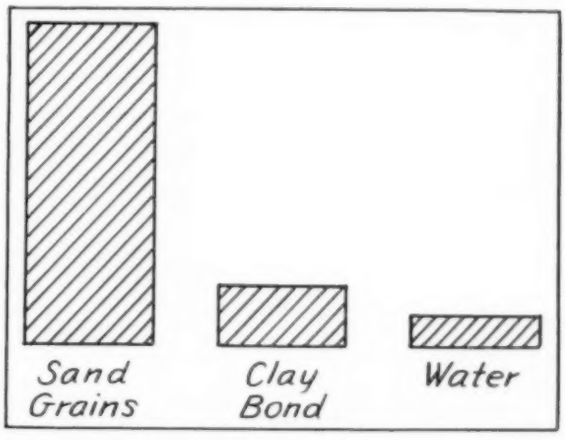
The metal brings into the picture such items as temperature, fluidity and rate of setting. All of these items may be summarized by stating that a foundryman should keep a written record of each sand characteristic and mold condition. The sand should be controlled to a specified moisture percentage, permeability, green and dry strength and fineness. Mold condition should be maintained to a definite mold hardness; flask designed to the most advantageous design; and molding sand harmonized with molten metal action.

A casting defect is made while the sand is hot. Water casting defects are those that originate from steam and molten metal agitation and also rough casting surface. Water also increases mold hardness, which in turn increases the total volume change of sand when heated.

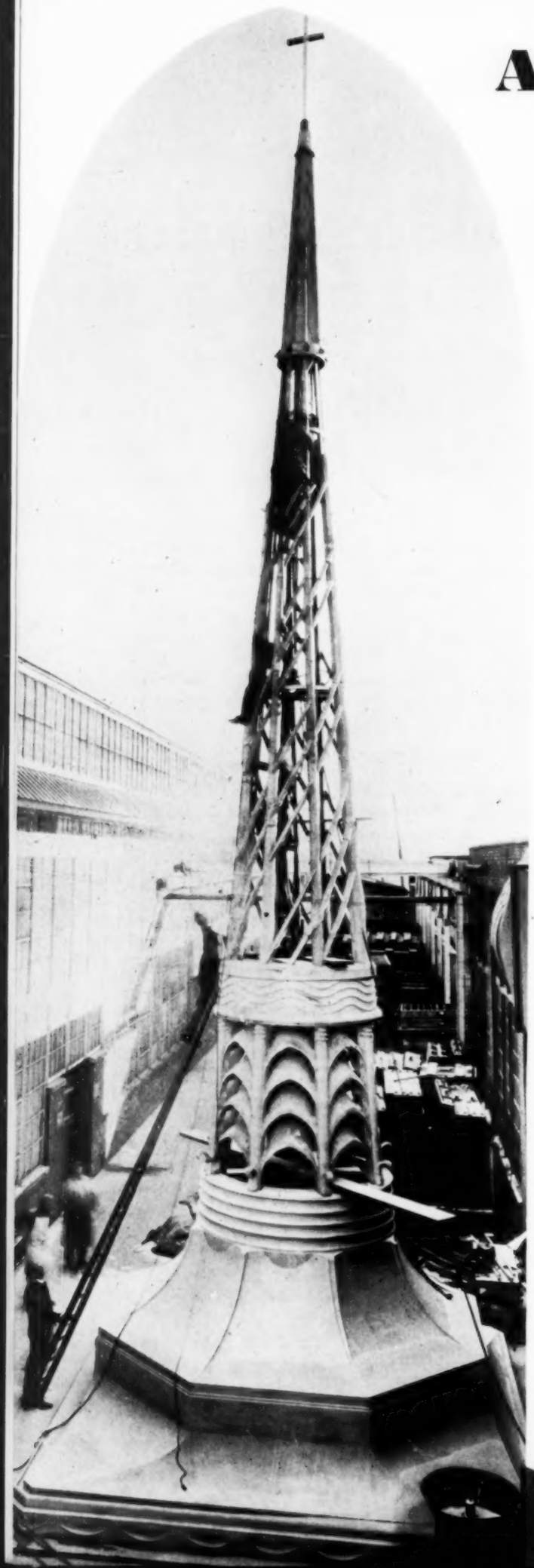
Clay defects are of two classes, namely, insufficient and excess clay. Insufficient clay casting de-

(*Please turn to page* 82)

Graphic representation of the volume of sand, bond and water in a synthetic molding sand containing 12 per cent clay, and 88 per cent silica sand. Water equals 5 per cent



Aluminum Castings



OPEN-WORK cast church spires are rare in architecture principally because it has been customary to rear solid structures into the skies. They might well be given more serious consideration in the future, for the laciness of their construction, which permits a view of the heavens at almost every point, inspires the steeple with a grace that is difficult to duplicate.

Fabrication is rather simple, for the erection of such spires merely means the coupling together of various metal supports and the attaching of cast sections. A saving in construction costs may be effected because the wind pressure on such spires is reduced and the bracing need not be as rigid as that of solid pinnacles.

Solve Problem of Construction

Aluminum was the material used in the construction of the spires of the German Evangelical Protestant Church, Pittsburgh, and Tyson Temple, Versailles, Indiana. The former was built in 1927, and was described in "Aluminum Castings Crown Pittsburgh Shrine" by W. H. Lloyd and Edwin Bremer, THE FOUNDRY, April 15, 1927. The latter was finished just a few months ago. The new church is a gift of James H. Tyson, and was named in honor of Elizabeth Tyson, his mother. Mr. Tyson, former Walgreen Drug Co. executive, is a native of Versailles. The new church is among a number of benefactions bestowed upon Versailles by Mr. Tyson, which include a library, a water works, and beautification of Cliff Hill cemetery.

Foundrymen will be interested in the problems which presented themselves in the construction of the steeple and in the manner in which these problems were solved.

The spire consists of a structural steel framework on which aluminum castings have been mounted. Since both metals expand and contract at different rates, provision was made by McGuire and Shook, Indianapolis architects, for separate expansion joints. These not only were generally distributed through the structure, but were so arranged that the expansion and contraction of the aluminum was independent of the supporting steel work. This construction was achieved by dividing the aluminum work into sections approximately 6 feet high, each of which is permitted to float free of

Fig. 1 (Left)—Placing the spiral units between upright members of the nearly completed spire. No. 43 alloy was used in those units while the cap castings for the special expansion joints in the vertical members were made of No. 214 alloy. The cross was fabricated from aluminum alloy rectangular tubing. Fig. 2 (Right)—View of the recently completed Tyson Temple, Versailles, Ind., which is surmounted by the aluminum alloy spire described in this article

Form Church Spire

the structural steel of the supporting framework.

All the aluminum work in the construction, with the exception of the final cross and the nuts and bolts, consisted of sand castings made from 82 different patterns. Most of the castings were made of an aluminum-silicon alloy. The total weight of the aluminum in the spire and base amounted to 7310 pounds, while the weight of the steel framework totaled 4100 pounds. The spire, from the sandcast base to the top of the cross, is just under 80 feet high. The diameter of the steelwork at the base of the spire is 9 feet and tapers to 1½ feet at the top of the main section. The castings were made in the Cleveland foundry of the Aluminum Co. of America.

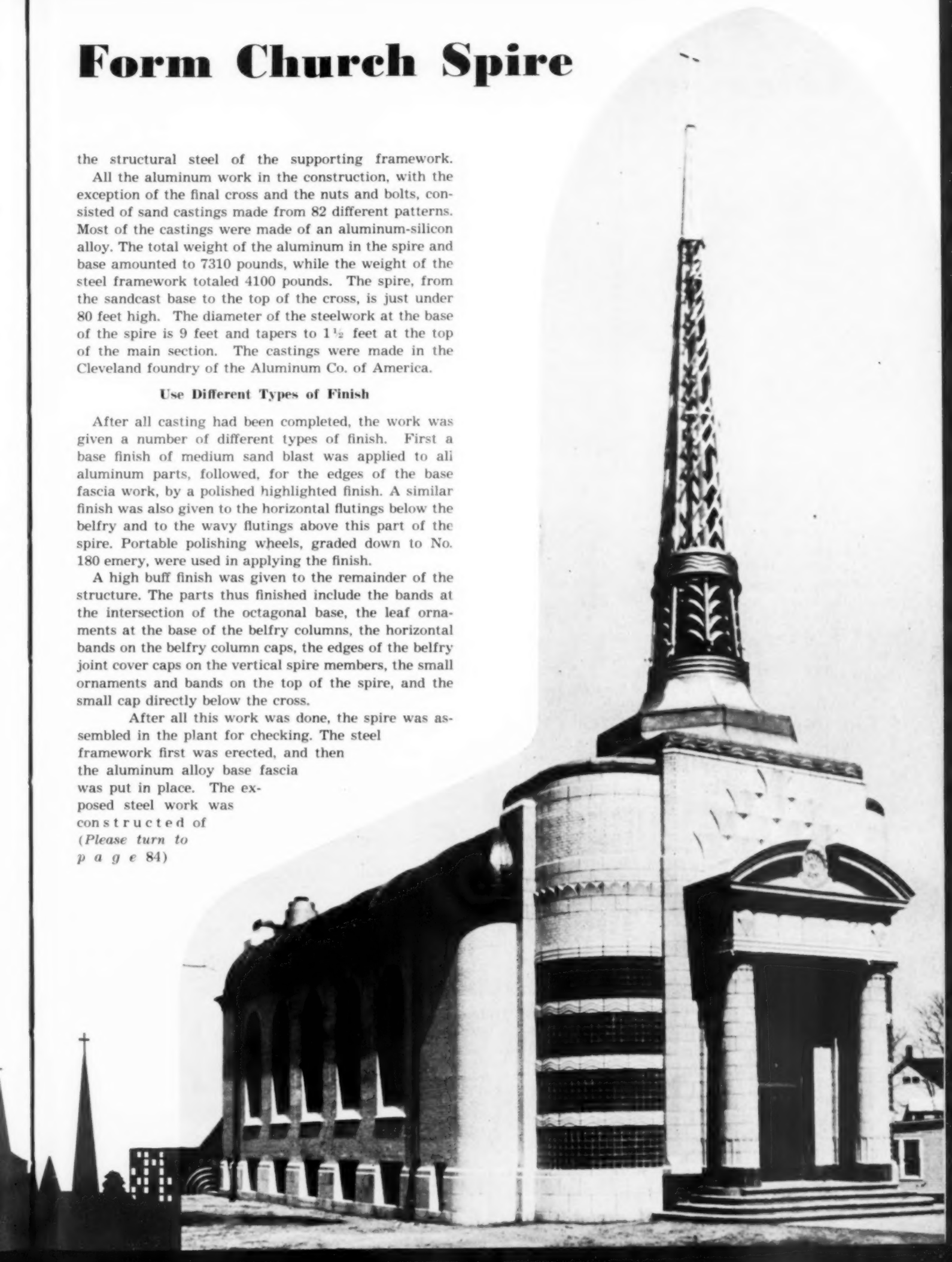
Use Different Types of Finish

After all casting had been completed, the work was given a number of different types of finish. First a base finish of medium sand blast was applied to ali aluminum parts, followed, for the edges of the base fascia work, by a polished highlighted finish. A similar finish was also given to the horizontal flutings below the belfry and to the wavy flutings above this part of the spire. Portable polishing wheels, graded down to No. 180 emery, were used in applying the finish.

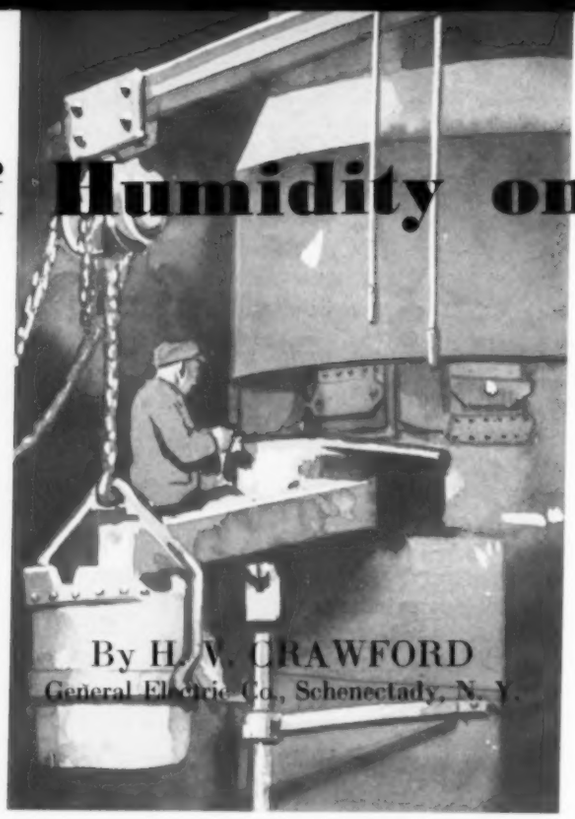
A high buff finish was given to the remainder of the structure. The parts thus finished include the bands at the intersection of the octagonal base, the leaf ornaments at the base of the belfry columns, the horizontal bands on the belfry column caps, the edges of the belfry joint cover caps on the vertical spire members, the small ornaments and bands on the top of the spire, and the small cap directly below the cross.

After all this work was done, the spire was assembled in the plant for checking. The steel framework first was erected, and then the aluminum alloy base fascia was put in place. The exposed steel work was constructed of

(*Please turn to page* 84)



Effect of Humidity on Cupola



By H. V. CRAWFORD
General Electric Co., Schenectady, N. Y.

ATMOSPHERIC air contains at all times a certain amount of moisture and, therefore, the effect of humidity on cupola operation has always been a puzzle to the foundryman. Some claim that it is a detriment and that better results will be obtained by removing the water from the air before it goes into the cupola. Others add coke to the charges to compensate for the moisture and at the same time adjust the volume of air to compensate for the varying humidity of the atmosphere.

Still others have gone so far as to actually increase the amount of moisture in the air by spraying water into the bed through the tuyeres. This is based on the idea that the H_2O breaking down into hydrogen and oxygen will give hydrogen to burn in the bed and more heat will be available. In other words, they would burn air with air.

Moisture Lowers Cupola Efficiency

It is the author's contention that adding moisture to the blast or wetting the coke lowers the efficiency and that any improvement obtained by adding coke to compensate for moisture is due to the amount of air being too high or coke too low in the first place. Also, that eliminating the moisture from the air will show an improvement in the operation due, however, most entirely to the fact, that in the process of eliminating the moisture the amount of oxygen supplied will be more nearly correct and more nearly a constant amount at all times. Any improvement due entirely to moisture eliminations will be insignificient. This is due to the fact that the variation in oxygen due to humidity is so small, in comparison to other variations, that it is of minor consideration. Even with the best practical control of the iron, coke, and air charges, the variations in any one of these will be more than enough to offset any corrections made for humidity.

The following information indicates clearly that humidity consideration in the operation of the cupola can be neglected, and that the best and most consistent results are obtained when a minimum amount of air and coke are used with the amounts of oxygen and carbon held constant, within as close limits as possible.

Calculations Based on 60-Inch Cupola

In making these calculations the following reactions of combustion involved in cupola operation are used. Also, for example there is used a cupola lined to 60 inches inside and melting twelve 1-ton charges per hour with an iron to coke ratio of 8 to 1 less bed. The carbon in the coke is figured at 90 per cent.

(1) $C + O_2 = CO_2 + 14{,}550$ B.t.u. per lb. C
2.667 lb. O + 1.0 lb. C = 3.667 lb. CO_2 + 14,550 B.t.u.

(2) $2C + O_2 = 2CO + 4350$ B.t.u. per lb. C
1.333 lb. O + 1.0 lb. C = 2.333 lb CO + 4350 B.t.u.

(3) $C + CO_2 = 2CO - 5850$ B.t.u. per lb. C
3.667 lb. CO_2 + 1.0 lb. C = 4.667 lb. CO − 5850 B.t.u.

(4) $2CO + O_2 = 2CO_2 + 10{,}200$ B.t.u. per lb. C
1.333 lb. O + 2.333 lb. CO (which contains 1.0 lb. C) = 3.667 lb. CO_2 + 10,200 B.t.u.

(5) $H_2O + C = CO + H - 5900$ B.t.u. per lb. C
1.5 lb. H_2O + 1.0 lb. C = 2.333 lb. CO + 0.1668 lb. H_2 − 5900 B.t.u.

(6) $2H + O = H_2O + 61{,}500$ B.t.u. per lb. H_2
1.0 lb. H_2 + 8.0 lb. O_2 = 9.0 lb. H_2O + 61,500 B.t.u.

Atmospheric air is used in the cupola to supply the oxygen necessary for combustion and according to the previous reactions, the oxygen combines with the carbon in the coke according to weight. The pounds of oxygen supplied in a given time will vary with the

volume of air used and the temperature, atmospheric pressure, and humidity of the air. If the air is furnished according to the old rule of 30,000 cubic feet per ton, not only will an excessive amount of oxygen be delivered, but the amount will vary over a wide range, due to atmospheric changes.

In the example stated above 12 tons per hour will mean 12 x 30,000 or 360,000 cubic feet of air per hour. With the air containing 7 grains of H_2O per cubic foot the total moisture will be 2,520,000 grains or, with 7000 grains to a pound, 360 pounds. With 360,000 cubic feet of air at 60 degrees Fahr. and 14.7 pounds barometric pressure, when air will weigh 0.0764-pound per cubic foot, the total weight will be 27,540 pounds. If then, 360 pounds of this is moisture the error due to moisture is 360/27,540 or only 1.3 per cent.

This is negligible and especially when compared to using the same volume of air in the winter when it will weigh, on many days, 0.09-pound per cubic foot or a total of 32,400 pounds. This is an error of 32,400/27,540 or 20 per cent excess, while in the summer at 0.0685-pound per cubic foot it will give 24,660 pounds or 11 per cent low. Oxygen delivered to the cupola, will vary from 20 per cent too high to 11 per cent too low or a total variation of 31 per cent. Variation only will be zero to 1.3 per cent due to humidity.

The figure of 30,000 cubic feet per ton is based on a ratio of 10 to 1, 100 per cent carbon in the coke and perfect combustion. This, of course, is impossible. Allowing for ash in the coke and coke burned before getting into the active bed, only about 100 cubic feet per pound of coke will be required. Therefore, at 10 to 1 or 200 pounds of coke per ton, only 20,000 cubic feet of air per ton will be required at 60 degrees Fahr. and 14.7 pounds per square inch barometric pressure.

Volume Less in Winter

For 12 tons this is 240,000 cubic feet instead of 360,000 and in the winter at 0 degrees Fahr. temperature and 15.2 pounds per square inch barometer, the volume should be 215,000 cubic feet per hour or 17,917 cubic feet per ton as compared to 285,000 cubic feet per hour or 23,750 cubic feet per ton in summer at 100 degrees Fahr. and 14.2 pounds per square inch barometer. A volume of 285,000 cubic feet of air will weigh 19,295 pounds and 285 pounds of this will be moisture, assuming 7 grains per cubic foot. This gives an error of 285/19,296 or 1.48 per cent or the oxygen will be 1.48 per cent low. Similarly 215,000 cubic feet in the winter will give 19,296 pounds of air and not any moisture so that there is not any error.

The previous error is to be compared with the error when using 360,000 cubic feet giving 24,660 pounds less 360 pounds of moisture or 24,300 pounds of air in summer or 32,400 pounds of air in the winter without any moisture. In the summer then, the ratio is 24,300 to 19,296 or 27 per cent excess and in winter 32,400 to 19,296 or 68 per cent excess. An error varying from 68 to 27 per cent excess compared to an error of zero to 1.48 per cent low.

When air is blown into the bed of a cupola the oxygen of the air combines with the carbon in the incandescent coke and a high temperature prevails in the bed. If there is any moisture in the air the temperature in the bed is sufficiently high enough to cause this H_2O to break down into hydrogen and oxygen in the proportion of 1 part of H_2 to 8 parts of O_2. According to equation (5), 1.5 pounds of H_2O breaks down into 0.1668-pound of H_2 and 1.3332 pounds O_2.

Therefore, with 360 pounds of H_2O, 360 ÷ 1.5 gives 240 and 240 × 0.1668 gives 40 pounds H_2 and 240 × 1.3332 gives 320 pounds O_2. Or 8/9 of the 360 pounds of H_2O is really oxygen as compared to 360 pounds of air containing only 23.1 per cent O_2 or 83.16 pounds of O_2. Therefore, with this much moisture in the air apparently there is a gain of 320 — 83.16, or 236.90 pounds of O_2.

To Prevent Excessive Oxidation

Either the air should be reduced or the coke increased to prevent excessive oxidation. The 40 pounds H_2O will combine with the 320 pounds of O until the temperature is too low to break the H_2O down again. This, means that the oxygen is 83.16 pounds low or an error of 1.3 per cent.

The previous calculations seem the most logical as there is not any reason for complicating them by figuring that equation (5) is completed by the 320 pounds of O coming from the 360 pounds of H_2O combining with C to form 560 pounds of CO.

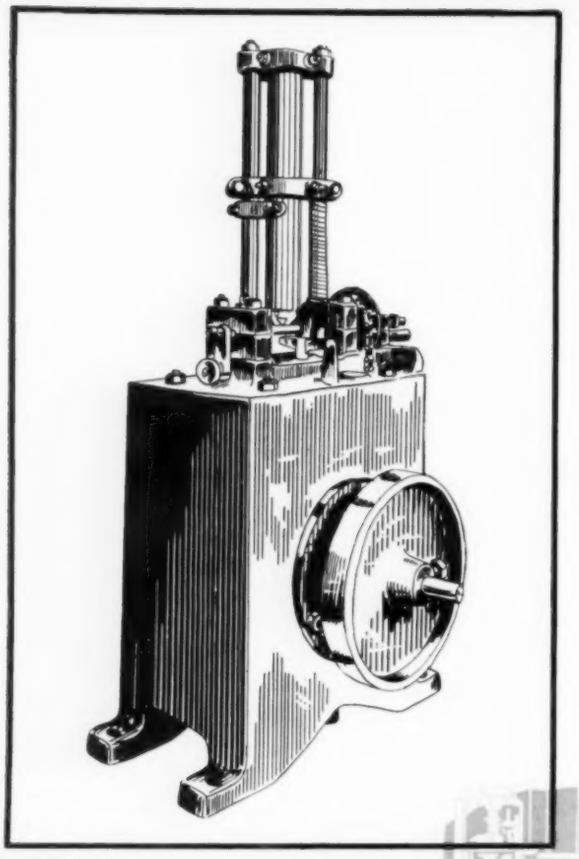
360 pounds H_2O + 240 pounds C = 40 pounds H_2 + 560 pounds CO — 1,416,500 B.t.u.

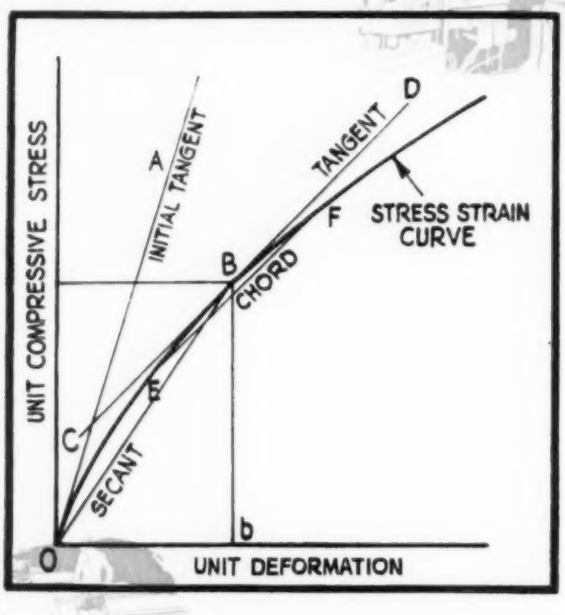
The H_2O breaks down in the bed, where O_2 from the incoming air is present, under which conditions it could be assumed that the 320 pounds of O_2 added would combine with carbon to form CO_2. If the bed is high and the H_2O breaks down above the point where all of the oxygen from the air is used up, the oxygen from the H_2O could combine with C to form CO_2 and then the CO_2 combine with more C to form CO. However CO will be present at this point and it is in the form of a gas and the O_2 released from the H_2O would combine with this to form CO_2 before it would combine with C to form CO_2 or CO. But previous to this, surely the H_2 and O_2 will combine again before the O_2 will combine with CO or C.

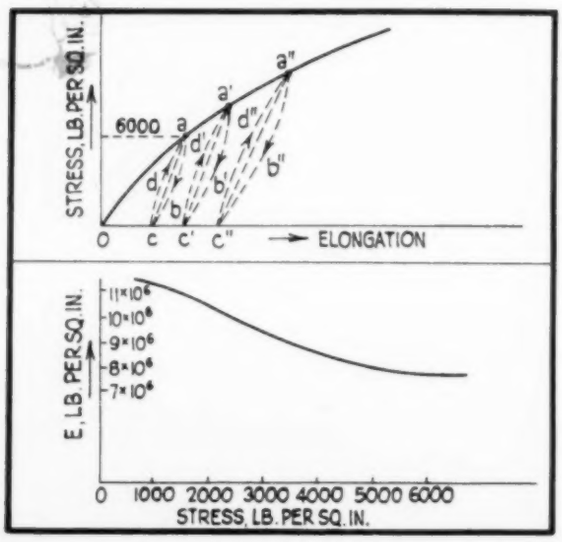
The previous reasoning indicates that the H_2O must break down and reform again and again, as long as the temperature is high enough. Therefore, the presence of moisture in the air even under maximum humidity conditions of the air has little effect on the operation of the cupola, other than the amount of oxygen is reduced a maximum of 1.3 per cent or possibly under extreme conditions, 1.5 per cent.

When the volume of air used is varied in order to keep the O constant and the moisture is not removed at maximum summer conditions the O_2 will be a maximum of 1.5 per cent low and the amount of heat available is reduced this percentage. Adding coke will not help any but in any case it is not readily practical to hold the carbon charged per minute within 1.5 per cent of what it should be.

It is easy to see, then, why adding moisture to the blast is not going to give any (*Please turn to page* 87)







Determines Cast

By JOHN M. LESSELLS

Professor of Mechanical Engineering
Massachusetts Institute of Technology,
Cambridge, Mass.

This article is abstracted from a paper presented by the author at the Joint Regional conference of the New England Foundrymen's association, the A. F. A., and the Massachusetts Institute of Technology held in Cambridge, Mass.

ONE of the important values obtained from the tensile test is modulus of elasticity. This usually is obtained in the case of steels by the slope of the stress strain graph for the elastic stages of the test. It usually is expressed as the ratio of stress to strain or

$$E = \frac{\text{Stress}}{\text{Strain}}$$

With materials like cast iron which do not give a straight line relation between stress and strain the determination of modulus values is more difficult. Nevertheless there probably is no more important material constant for the designer than the value of E since it enters into all deflection problems. The quoted values of E for cast iron vary from 60,000,000 to 100,000,000 pounds per square inch. This variation is much too wide for the engineer and the foundryman ought to see to it that more constant, or rather consistent results are obtained.

Suggests Method for Cast Iron

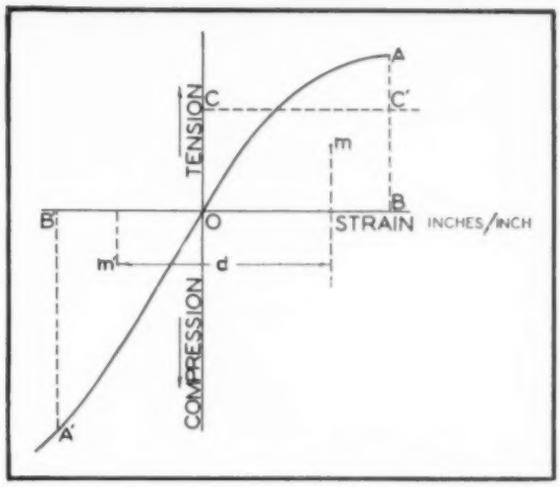
Due to this, various methods of determining modulus values have been suggested, some of which are shown on Fig. 1 for bars tested in compression.

A method which has been used by the writer might be employed. In this method a stress-strain relationship for cast iron for a series of cycles of loading and unloading are attained as in Fig. 2.

The load on reaching *a* is removed and the curve *abc* is obtained. On reloading the curve does not follow the original path but that of *cda*. The modulus corresponding to the stress at *a* is given by the average slope, namely *ca*. Repeating this for different stress values data are obtained from which the modulus-stress curve shown in Fig. 2 can be plotted. This indicates how the modulus of elasticity varies with stress for the particular iron under consideration. This method if applied more generally might produce valuable results as a means for comparing different irons, at least it would provide the engineer

Fig. 1 (Top left)—Eden-Foster repeated bending impact testing machine. Fig. 2 (Center left)—Various methods of determining modulus values. Fig. 3 (Left)—Stress-elongation and modulus-stress curves

Iron Properties



with consistent modulus of elasticity values.

In an important contribution to the literature Pearce suggests that the total deflection made up two parts plastic and elastic be separated by a system of loading and unloading and the modulus of elasticity determined from the line of elastic deflection which usually is a straight line as shown in Fig. 3.

Several values obtained by Mr. Pearce are tabulated in the Table I. It will be seen that the modulus seems to vary with the composition. The third is a white-heart malleable iron and we expect a higher modulus value even though the tensile strength is lower than No. 1. It seems that this method offers better opportunities for studying modulus values than the conventional one.

Transverse Test Widely Used

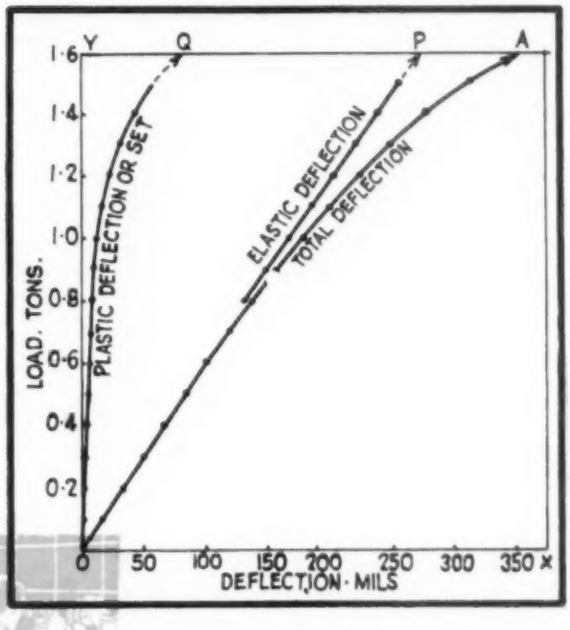
The transverse test is widely used for the foundry control and specifications of cast iron. In this test the bar is supported on knife edges and broken by a load applied at the middle of the span, as indicated in Fig. 4.

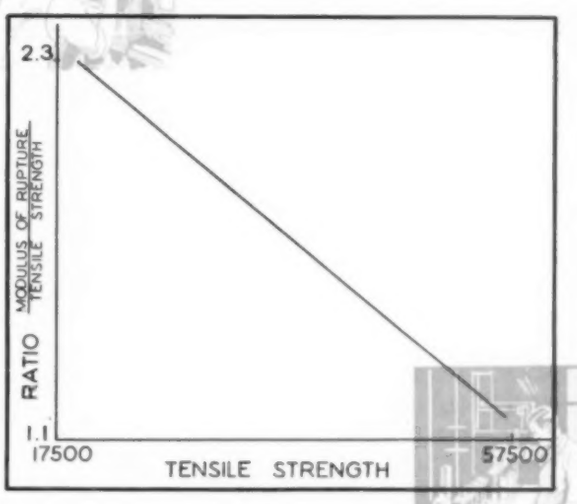
The development of this relation assumes that the material deforms in such a way that the deformation is proportional to stress. It also assumes that the value of c remains constant. The neutral axis shifts as the material deforms and stress is not proportional to strain, consequently the actual fiber stress is not more than 50 to 60 per cent of the modulus of rupture. The test is valuable but it is difficult to correlate values obtained for different spans.

The transverse test is dependent also on the size and shape of the specimens and the length of the span. Small specimens show relatively higher transverse strength than specimens of large section. Round sections appear to have a higher modulus of rupture.

From the previous discussion it can be seen that for softer irons there is more divergence from proportionality between stress and strain and consequently more discrepancy between tensile strength and modulus of rupture. This is seen from Fig. 5 reproduced from page 83 of the *Cast Metals Handbook*.

Due to these discrepancies it is surprising that no greater efforts have been made to correlate the transverse strength with the tensile test. As regards the importance of the latter, that is well known. The handbook states on page 79 that tensile strength is regarded as one of the most important properties of cast iron (*Please turn to page* 90)





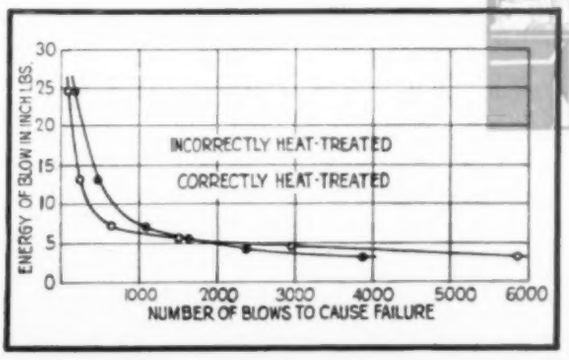


Fig. 4 (Top right)—Tensile versus transverse properties. Fig. 5 (Next below)—Load deflection curves. Fig. 6 (Next below)—Ratio of modulus of rupture to tensile strength. Fig. 7 (Right)—Repeated impact results obtained by Stanton's method

QUESTIONS and ANSWERS

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Coke Bed Does Not Cause Slow Melting in the Cupola

We melt approximately 2500 pounds in a small cupola lined to 18 inches. The charges of 175 pounds are made up of one-third pig iron, one-third scrap iron and one-third steel rails. The tuyeres are 20 inches above the bottom. We use 350 pounds of coke on the bed and 30 pounds between the charges. The melting speed is about 1000 pounds per hour. We are wondering if this thick bed of dead coke is responsible for the sluggish melting.

Under favorable conditions a cupola lined to 18 inches should melt about 2000 pounds per hour. The amount of coke below the tuyeres—within reasonable limits—is not a factor of any importance, but the height of the bed above the tuyeres exerts a marked influence on the speed of melting and on the temperature of the iron. However, in the present instance the 350 pounds of coke in the bed should extend to a point about 3 feet above the tuyeres and that should be satisfactory.

Some other factor is responsible for the slow melting speed. The following points are submitted for your consideration. The bed should be burned through bright before charging commences. The material in the charges should be broken into small pieces. The blower should deliver 500 cubic feet of air per minute at a pressure of 6 to 8 ounces. The first iron should commence to dribble down in from 7 to 10 minutes after the blast goes on.

Describes Procedure To Follow In Making Welding Rods

We are producing welding rods in our own use. Our base iron has the following analysis: Total carbon, 3.40 to 3.50 per cent; sulphur, 0.090 per cent; nickel, 0.10 to 0.15 per cent; silicon, 2.35 to 2.40 per cent; manganese, 0.65 to 0.70 per cent; phosphorus 0.17 to 0.20 per cent, and chromium 0.08 to 0.12 per cent. To this base iron we added sufficient 50 per cent ferrosilicon to raise the silicon content about 0.30 per cent. Machinability of welds produced from these rods, however, was not as satisfactory as desired. We also tried introduction of nickel up to 0.35 per cent with similar results. The temperature of our iron is within the range of good cupola iron, nevertheless any greater addition of ferrosilicon in an attempt to raise the silicon content still further meets with bad results due to the chilling effect of larger additions to the same body of iron. It is our understanding that welding rods carry a considerably higher phosphorus content than normal gray iron, that is to say 0.60 to 0.80 per cent. Could you suggest any way by which the phosphorus can be increased through ladle additions? Or would you encourage a trial with the objective in view to increase the total carbon by means of petroleum coke? If so, how much of a carbon pick-up could be expected from such procedure.

It is our understanding that cast iron welding rods usually have a composition containing a much higher silicon content than you indicate. For example, one suggested analysis contains 3.0 to 3.5 per cent silicon; 0.100 per cent maximum sulphur; 0.50 to 0.70 per cent phosphorus; 0.50 to 0.75 per cent manganese, and 3.0 to 3.5 per cent total carbon. You also will note that the phosphorus is higher than in the iron you have, but we do not believe that it is essential to be as high as that except perhaps from the viewpoint of fluidity for pouring thin sections.

We believe that your present total carbon is sufficiently high, and that you would have little success in trying to increase it through use of petroleum coke without an electric furnace to maintain the metal at the high temperature for a long period of time. However, we believe that raising the silicon probably will give you the desired results on machinability. You mention that you now are having difficulty in increasing the silicon content 0.30 per cent and that an attempt to increase it further chills the iron too much.

Evidently you are only using a small quantity of metal at a time for casting the welding rods, and as

long as you continue that practice you will have difficulty from the chilling effect. We believe that at least 200 pounds of molten metal should be used. Another essential is to have a hot ladle. Probably the easiest way to insure that is to take one that is being used to pour off the heat. A third essential is to have the ferrosilicon in fairly finely divided form, that is crushed to say about 12 mesh, and to have the crushed ferrosilicon as hot as it is possible to get it.

One method of attaining that would be to place the ferroalloy on a shovel and hold it over a fire until they both were red hot. The procedure to be followed consists in running in the molten metal until the bottom of the ladle is just covered, and then adding the ferroalloy in a stream from the shovel so that the stream of ferroalloy strikes the molten iron at the juncture of the cupola stream and the top of the bath. That will insure not only the ferroalloy entering at the hottest point but also a good mixing action which, of course, is important.

Probably by coating your present welding rods with a mixture of silicon carbide (an abrasive material sold under the trade name of carborundum, crystolon, etc.) and graphite may give you satisfactory results. That procedure we believe is patented.

Small Chilled Wheels Show Dirty Spots on Surface

We rub a coating of oil and plumbago on the chills for our small chilled wheels 14 and 16 inches diameter, 2 to 4-inch face. The tread of the wheel is clean with the exception of what looks like dirty spots nearly one-third of the way around. We have molded them in green sand and dry sand. We have poured them from the bottom and popped them on the hub. We find no cuts or scabs on the castings, but the defective spots look like dust or dross. These light blemishes do not affect the utility of the wheels, but we should like to have a perfectly clean surface.

Streaks or dirty spots on the tread of a chilled wheel may be due to one or a combination of two causes: Dirt flowing in with the metal, or material washed from some part of the mold. Dirt from the outside may be slag floating on the ladle, or may be sand washed from the pouring basin. From your description of the various methods tried, we may assume that you have taken proper precaution to prevent any dirt from flowing in from outside. From the fact that you find no cuts, washes, as scabs on the surface of the casting, we may assume that the iron did not dislodge any of the sand surface of the mold.

The only remaining probable source of the dirt is the coating on the chill. Some of this material becomes dislodged, floats a short distance, and then coming again in contact with chill, adheres to the surface. The obvious remedy is to remove this hazardous feature. Chills for small wheels need no coating, so long as they are clean and perfectly dry. However, since they are in green sand molds for varying periods, they condense some moisture from the sand, therefore it is necessary to coat them lightly with a thin oil, gasoline or kerosene rubbed on with a handful of waste or an oily rag.

Hard Sand Match Is Suitable For Short Order Jobs

We are using a proprietary compound for matchplates on many of our patterns, but a less enduring material would be satisfactory for short orders. We shall appreciate information on how to prepare hard sand matches.

Hard sand matches for short jobs in the foundry are made by mixing dried molding sand with linseed oil—just enough to dampen the sand to working consistency—and about a small handful of litharge to each batch. The cope part of split pattern or patterns is placed on a board and the cope is rammed in the usual way with this mixture. It is lifted off or rolled over and the joint is finished carefully. Nails are inserted wherever it is considered necessary to strengthen corners, etc. The cope then is allowed to dry and harden over night.

On solid patterns with an irregular parting line, the pattern is bedded in a sand drag and a rough approximate parting is made. Then the cope is rammed full of the special mixture, both parts are rolled over, the false drag is shaken out, and the parting on the cope finished carefully as in the first instance. Instead of a cope, a plain frame may be used with suitable guides for locating the pins. To reduce weight the frame is made as shallow as possible and is reinforced by nailing or screwing a board on the back. Some foundrymen favor damp fireclay instead of the oil sand mixture. An extended description of the application of this material was presented in the June, 1934 issue of THE FOUNDRY.

Iron Evidently Is Responsible For Appearance of Slag

We are having trouble with what apparently is slag dissolved in the iron. We have tried all kinds of fluxing materials in an effort to produce a slag that would float on top of the iron either in the cupola or in the ladle. Teapot spouts on the hand ladles hold back the floating slag, but the slag trapped in the iron enters the mold and appears later as defective areas on the castings.

This is a problem which turns up occasionally and one on which foundrymen hold divergent opinions. We favor the opinion held by men who claim that the trouble is caused by the particular pig iron in use at the time. This opinion is supported by the claim that trouble disappears when another iron is substituted.

This has no reference to the small quantity of ordinary slag which occasionally is found floating on top of the metal in a ladle and which can be caught by a skimmer, a handfull of sand on the surface, or that can be trapped by a suitable gating system. Your reference is to the apparently mysterious material that seems to be held in solution in the iron and appears only after the metal has solidified, sometimes even on the drag face of the casting. Analysis of the iron will not reveal this characteristic. However, if the metal leaves the spout white hot and then freezes much more rapidly than it should, you may accept that feature as fairly conclusive evidence that it is one of the slag grabbing irons.

May Change Cupola Tuyere Height

Our cupola lined to 40 inches is used for melting iron for stoveplate castings and only rarely is it necessary to hold any amount of iron in the well. At present the bottom of the back tuyere is about 10 inches above the sand bed. We are in favor of lowering the tuyeres to a point 4 inches above the sand bed with a consequent saving of the volume of coke required in the bed, but our foundry department claims that melting conditions would not be as satisfactory as at present.

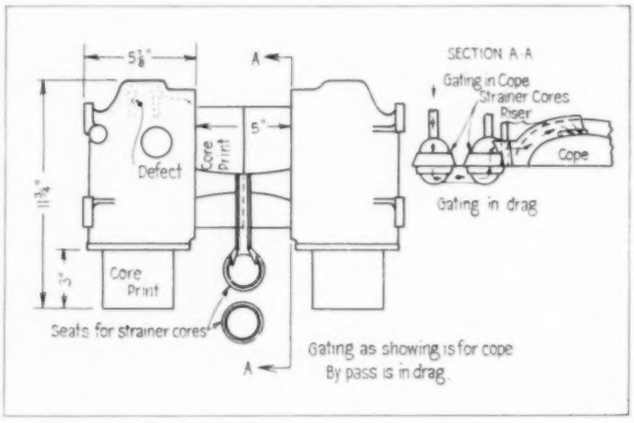
As a general rule it is inadvisable to tamper with a cupola that is performing satisfactorily. So many factors must synchronize harmoniously that the changing of one may throw the other out of tune. However, in the present instance you have precedent to guide you since in many stoveplate foundries the cupola tuyeres are as low as 4 to 6 inches above the sand bottom. The change in your cupola would mean a saving of approximately 100 pounds of coke per heat, or a total of approximately 15 tons in a 300 working day year. With an acetylene torch you could cut a new set of tuyere openings in the shell, lower the tuyeres and rebrick the affected area at a reasonable cost. The experiment seems worthwhile. You always have an ace in the hole in the event that the experiment does not work out satisfactorily as the tuyeres easily may be restored to the original position.

Shrinks Slightly In Center Boss

We are forwarding part of a small crankcase casting, also rough sketch showing gating method and location of a small defect in a central boss. The casting is poured from metal melted in an electric furnace at a temperature of 2750 degrees Fahr. Silicon content is 2.40 per cent with total carbon 2.90 per cent. The core is made from half and half silica and No. 1 Albany sand with cereal and oil binder in the proportion of 1 to 40. We are at a loss to determine if the defect is caused by dirt or shrinkage and will appreciate your comment.

The fact that the casting is perfect in every particular with the exception of the small defect in the bore of the internal boss, would seem to indicate that the gating system, the metal and core are satisfactory, hence we may dismiss the idea that any dirt entered with the iron. The defect apparently is a draw, but whether this draw is shrinkage defect pure and simple, or is partly due to a slight *kick* of the metal in the space surrounded by several projecting parts of the core, is an open question.

If the defect is merely a shrink that appears regularly, it may be cured by a nail in the core with the head projecting into the space where the shrinkage occurs. The nail of course must be perfectly clean. If the defect is caused by a slight fluttering of the metal in the vicinity, the obvious remedy is to place an extra vent in the core in the vicinity.



Slight fluttering of core in confined space may be responsible for defect

What Occurs During Annealing Cycle

Will you please advise us as to just what happens during annealing of malleable castings? Does the packing material in the annealing pans have any direct decarbonizing effect on the castings?

To give you all the information you request, would require a lengthy explanation, but in brief it consists primarily in the conversion of the metastable system iron-iron carbide into the stable system iron-carbon. That involves no change of chemical composition, and is not the effect of any chemical action on the iron by packing, furnace gas, or other substance.

The only chemical reaction involved takes place within the iron carbide or cementite of the iron, and involves only the chemical elements present within the iron, leaving an unaltered amount before and after the reaction. According to Schwartz, under commercial annealing conditions the castings always are in an atmosphere having oxidizing possibilities. That atmosphere may be the atmospheric air remaining in the spaces not otherwise occupied, or it may be the products of combustion or gases arising from reactions with packing materials.

Therefore, there always is a tendency toward burning out the surface carbon. Schwartz also states that decarburization is controlled in practice by the character of the packing material; or perhaps more accurately, the results in practice depend on the packing used, there being but little available information with regard to the action of packing.

Commercial packings depend for their activity chemically on the reduction of ferric oxide to ferrous oxide. Packings in use as distinguished from the raw packings, are complex silicates and not oxides. The practical annealer unconsciously relies on this knowledge where he limits his additions of roll scale or other raw materials to small amounts at any one time; for a packing containing any large amount of free oxide is not a workable material.

Ferrous silicates are incapable of reduction to metallic iron under the usual annealing conditions, so that the oxygen for oxidizing the carbon is derived primarily from the reduction of ferric oxide to ferrous oxide; although the ferrous oxide of the pot and roll scale may enter into the reaction. Relative amounts of carbon monoxide and carbon dioxide formed, depend on the temperature and the packing used. With the materials and temperature of commercial practice, the ratio is fairly constant; approximately 12½ per cent of the carbon being burned to carbon dioxide, the remainder to carbon monoxide.

Oxidation of the carbon in the iron and reduction of the packing are accomplished by the gas surrounding both. To be operative, a system must be chosen in which the ratio of carbon monoxide to carbon dioxide can be maintained which will at the same time oxidize cementite, reduce ferric oxide, and reduce ferrous oxide.

Consequently the answer to your question on whether the packing material has a direct decarburization effect on the castings, is that it has not—mainly because the packing is not composed of oxides, but of silicates, and as such does not supply

oxygen directly. Also, it might be pointed out that malleable iron castings are being annealed successfully in inert packing such as slag, and also in other instances, through the use of muffle type or radiation type furnaces, in which the castings are protected from the gases of combustion generated by the fuel, no packing material of any kind is employed.

Valve Castings to Resist Impact

We are interested in the manufacture of oil valve castings which have to comply with a specification calling for a minimum Izod test of 15 foot pounds. We would be pleased to know if you could inform us the best analysis of the steel and the method of annealing for such castings to avoid undue stresses on the body of the casting.

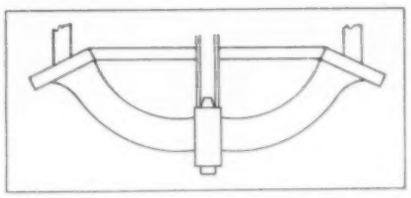
The least expensive analysis which will give an Izod test of 15 foot pounds is so-called intermediate manganese steel. A good analysis for this material is as follows: Carbon, 0.20 to 0.30 per cent; silicon, 0.30 to 0.50 per cent; manganese, 1.10 to 1.50 per cent; and phosphorus and sulphur, below 0.05 per cent. The castings should be heat treated by heating 2 to 4 hours at 1650 degrees Fahr., cooling in the air, and reheating from 4 to 6 hours at approximately 1250 degrees Fahr. and again cooling in the air. If preferred, the final cooling may be in the furnace instead of in the air.

Another good analysis for this material is a chrome-nickel steel of the following approximate range: Carbon, 0.20 to 0.30 per cent; silicon, 0.30 to 0.50 per cent; manganese, 0.50 to 0.70 per cent; phosphorus and sulphur, below 0.05 per cent; chromium, 0.60 to 0.80 per cent and nickel, 1.50 to 1.75 per cent. The recommended heat treatment would be to heat for 2 to 4 hours at 1600 degrees Fahr. and cool in the air, followed by 4 to 6 hours at 1250 degrees Fahr. and cooling in the furnace.

Either of these analyses will give a considerably higher impact test if the castings are quenched in oil, from 1650 or 1600 degrees Fahr. instead of cooling in the air. However, oil quenching of complicated castings should only be undertaken by those familiar with the work and in many cases it will be necessary to remove the castings from the oil as soon as they have cooled below red heat, and place them immediately in a warm furnace for second heating. This precaution is desirable to minimize the chances of cracking the casting.

Blowholes Appear in Bevel Gear Face

We are having trouble with a bevel gear blank 31 inches diameter, rim 5 inches wide and 2 inches thick. The hub 3 inches diameter and 6 inches high is not on the same plane but is 6 inches above the rim to which it is connected by four curved arms as shown in the accompanying sectional view. When shaken out the casting is clean with no sign of cuts, washes or scabs, but after the first cut is taken from the face in the machine shop, a honeycomb surface appears, sometimes all over, and sometimes the blowholes are scattered in clusters. The blowholes are blue and contain shot. We place two 3-inch square risers on the face and keep them covered until the mold is filled. Metal is poured through two ⅝-inch diameter pop gates on the hub. The iron contains 30 per cent steel, with 1.65 per cent silicon and 0.75 per cent chromium. The mold is made in green sand, average moisture content, rammed carefully and well vented. From the color of the blowholes I am inclined to the opinion that gassy metal is responsible for the trouble.



The finished face of the casting should be molded in the drag instead of in the cope as shown here

While it is possible that burned or oxidized iron is responsible for the blowholes, still the weight of the evidence presented in your diagnosis seems to indicate that the mold is responsible. Your sketch shows the face of the wheel in the cope which is contrary to universal foundry practice of placing a machined face wherever possible in the drag. In this particular instance the metal flowing down through the gates in the center and then up through the four arms creates a great deal of steam and a certain amount tries to escape through the metal in the wide rim of the wheel. The eruption is particularly violent in the vicinity of the junction of the arms with the rim. The proper way to mold the wheel is face down, with sand a little dryer than usual under the face and adequately vented. The present type of gates and risers may be used, but no useful purpose is served by covering the risers. With this method, an iron flask, or a stiff wooden flask is required to prevent the mold from straining. Incidentally it may be pertinent to suggest that with a mold properly made in a good stiff flask, no riser should be necessary on the rim of the wheel. With the face in the drag the rim will fill first and will be fed from the arms.

Definite Height Is Not Important

In a recent inquiry one of your readers asked for some data on a small cupola with a melting capacity of 1000 pounds per hour. In your reply you omitted to mention the total height of the cupola, height and size of tuyeres, and method of charging the cupola, whether from the top or through a charging door.

Checking back over the item to which you refer we find that the inside diameter of a cupola for melting 1000 pounds per hour is given as 18 inches, with the tuyeres 8 inches above the bottom. These are the only really essential features. The total height of the cupola is immaterial, and the question of whether to charge through the top or through a door in the side depends on the potential fire hazard.

If the cupola is set up in an open space under a high roof it may be charged through the top. Under other conditions it may be necessary to carry the stack through the roof and naturally the charging will be done through a hole in the side at any convenient height. In the first instance the minimum height for the shell of the cupola is approximately 4 feet. In the second instance the bottom of the charging door is about the same distance from the sand bottom. The shell above the charging door may be continued full size through the roof, or it may be contracted to a much smaller size, say 18 inches diameter.

The main shell of a cupola lined to 18 inches is 27 inches in diameter to allow for a 4½-inch brick lining. In the majority of instances the small cupola has no stack and is charged through the top. Where a stack is necessary it is provided with a hood at the bottom and is suspended above the open top. This arrangement allows the cupola man to effect repairs from the bottom and from the top. In some instances the cupola shell is mounted on swivels for the same purpose. In other instances the body of the cupola is mounted on wheels so that it may be pulled out from under the hood for repairs. For your further information three tuyeres 3 inches in diameter will be sufficient. The blower will be required to deliver approximately 300 cubic feet of air per minute through a 5-inch diameter pipe at a pressure of 5 or 6 ounces.

George S. Haley

Joseph Sully

Fred A. Wagner

Dr. A. Allan Bates

MEN of INDUSTRY

GEORGE S. HALEY, general manager, Century Foundry Co., St. Louis, and recently elected chairman of the St. Louis District Chapter of the A.F.A., was born in Batavia, Ill., in 1879. He attended the public schools in that city and on graduation from high school became an apprentice machinist with the Challenge Co., Batavia. Mr. Haley remained with that firm until 1906 serving as machinist, patternmaker, toolmaker, foreman of tool and pattern shop, and assistant superintendent.

During that period he attended Armour Institute of Technology and Lewis institute, Chicago, taking special work, and in 1906 he became special machinery designer and draftsman for the Western Electric Co., Chicago. The following year he became chief draftsman for the Mueller Co., Decatur, Ill., and occupied that position for 9 years. Mr. Haley then resigned to become superintendent, A. Y. McDonald Mfg. Co., Dubuque, Iowa. In 1921 he entered business for himself, and later returned to the Challenge Co. as production manager.

In 1925 he accepted a position as works manager, Gardner-Denver Co., Quincy, Ill., which he held for 3 years, and then returned to the Mueller Co. as chief engineer. In 1931 he became associated with Chase Brass & Copper Co., Waterbury, Conn., as foundry engineer and engineer of plumbing manufacture. Mr. Haley resigned that position to accept his present connection.

• • •

JOSEPH SULLY, president and general manager, Sully Brass Foundry Ltd., Toronto, Ont., who recently was elected chairman of the Canadian section of the A. F. A., was born in Toronto in 1894. He attended the public schools of that city and also of Montreal, Que. Following that he attended a technical school in Toronto specializing in a business course. Upon graduation, he engaged in secretarial work for several years and then entered into sales and advertising in the heating specialty manufacturing industry. In 1919 he entered into business with his father, forming the Sully Brass Foundry Ltd. That foundry was one of the first Canadian jobbing foundries to install electric furnaces, blast cleaning machines, and core blowing equipment.

• • •

FRED A. WAGNER, vice president in charge of manufacturing, Centrifugal Fusing Co., Lansing, Mich., formerly was manager of fusing operations at the Campbell, Wyant & Cannon Foundry Co., Muskegon. Mr. Wagner was works superintendent of Goulds Pumps Inc., Seneca Falls, N. Y. from 1914 to 1923. He then operated his own consulting business and worked in connection with the bureau of standards, Washington, until 1927, when he became master mechanic of the Campbell, Wyant & Cannon Foundry Co. in Muskegon. He was appointed superintendent of the centrifugal division in 1932.

Centrifugal Fusing Co. has taken a lease from Campbell, Wyant & Cannon Foundry Co. on the newly completed fusing plant constructed by the Motor Wheel Corp. The new plant has a capacity of over 30,000 tons of centrifugally fused products per year.

• • •

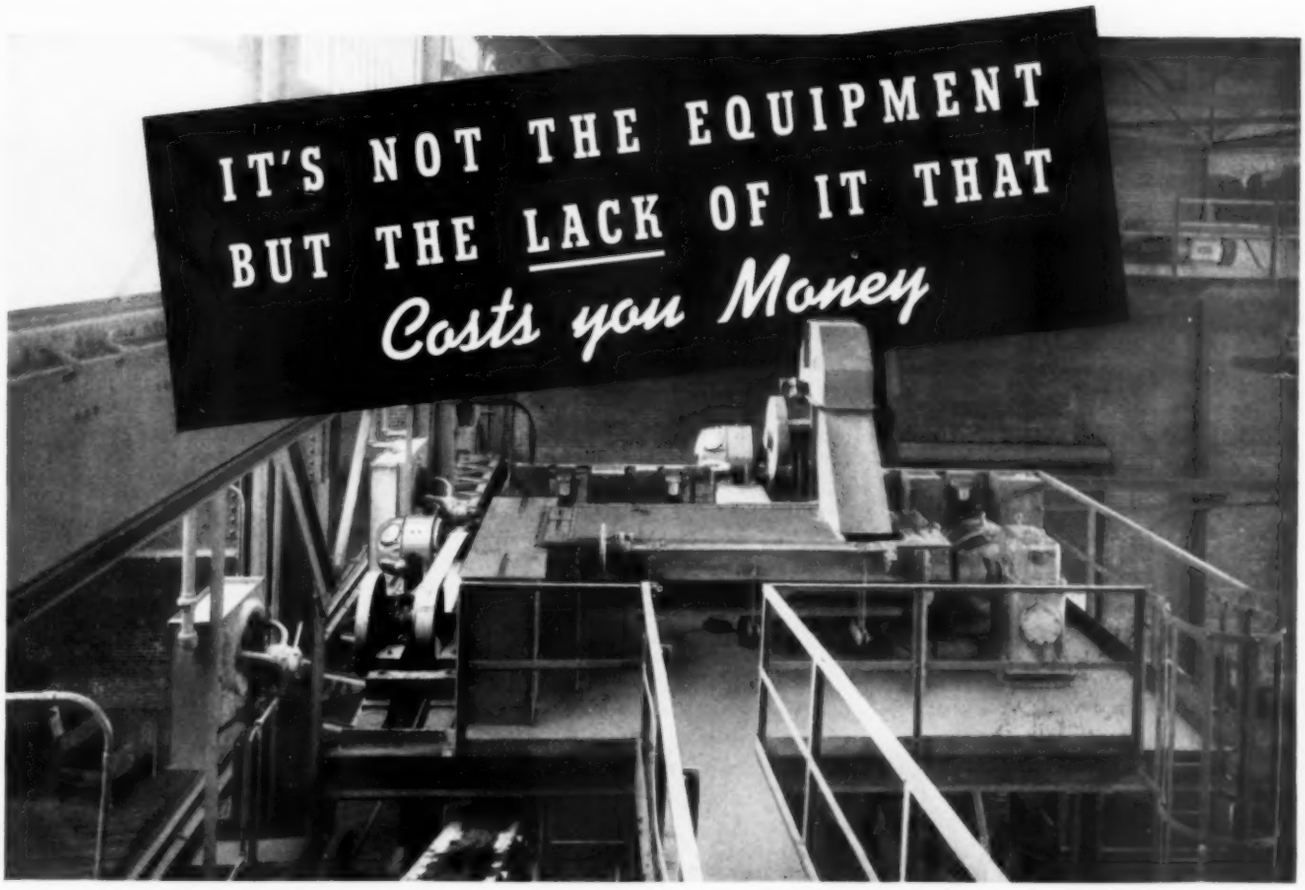
DR. A. ALLAN BATES recently joined the staff of Westinghouse Research Laboratories as manager of the chemical and metallurgical division. Dr. Bates formerly was professor of metallurgy at Case School of Applied Science and served as consultant for a number of companies in the Cleveland area. Previously he was employed by the National Tube Co., and was also research metallurgist for the National Malleable & Steel Casting Co.

Dr. Bates was graduated from Ohio Wesleyan in 1923. He then attended Case School and received a B. S. in metallurgy. From 1930 to 1931 he attended the Ecole De Metallurgie, University of Nancy, France, from which he received his degree of Doctor of Science in metallurgy.

• • •

GEORGE E. CARLIN has returned to the Continental Roll & Steel Found-

(*Continued on page* 44)



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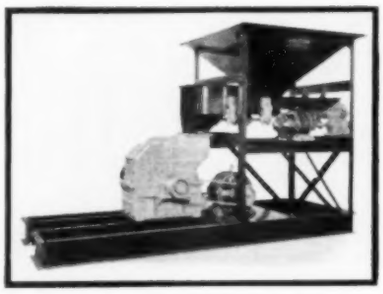
THE *Savings* THEY HAVE MADE FOR OTHERS



BARTLETT-SNOW CORE CRUSHER...a complete unit—with hopper, feeder and swing hammer crusher... ideal for reclaiming core sand.

BULLETIN No. 75. Complete with 120 illustrations and 26 engineering diagrams, this 44-page booklet describes the Bartlett-Snow method of securing less costly; more efficient operation. Send for one!

• Bartlett-Snow sand conditioning equipment is demonstrating repeatedly the superiority of a design that meets all the requirements of the most exacting foundry service. Production per square foot of floor space with Bartlett-Snow equipment is usually doubled . . . sometimes trebled. Delay and confusion are avoided. Working conditions are improved. A cleaner, more orderly—and more profitable—operation results than would otherwise be possible.

Let us show you what Bartlett-Snow revolving screens, aerators, pug mills, storage bins and other sand conditioning equipment are doing in large and small, continuous production and jobbing, brass, aluminum, steel, malleable and grey iron foundries . . . and the savings they can make for you. The investment in equipment need not be large. What are your foundry problems?

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BARTLETT·SNOW

SAND HANDLING AND SAND CONDITIONING EQUIPMENT
MOLD CONVEYORS AND ACCESSORY FOUNDRY EQUIPMENT

ry Co., East Chicago, Ind., after an absence of 2 years. During that time he was in Tuscon, Ariz. for his health. Mr. Carlin served his apprenticeship with the Poole Engineering Co., Baltimore. From 1901 to 1905 he was connected with Filer & Stowell Co., Milwaukee, in charge of loam molding. He then was connected with the Sheffield Foundry Co., Chicago, and later the Gates Iron Works of Allis-Chalmers Mfg. Co., Milwaukee. He then went with the Elevator Supply & Repair Co., Chicago and following that was connected with the Champion Corp.,

William D. Dunn
—recently appointed superintendent, Marion Malleable Iron Works, Marion, Ind., as mentioned in the August issue

Hammond, Ind. and the United Boiler Heating & Foundry Co. of that city.

♦ ♦ ♦

HARRY W. DIETERT, Harry W. Dietert Co., Detroit, sailed Aug. 14 for a European trip covering England, France, Germany, Denmark, Sweden and Norway.

♦ ♦ ♦

KERMIT DONALDSON, assistant sales manager, Machined Steel Castings Co., Alliance, O., has been made plant superintendent of the company, succeeding L. C. HETZEL, who resigned because of ill health.

♦ ♦ ♦

J. A. FIX, plant manager of the South Bend, Ind. division of Oliver Farm Equipment Co. since 1933, has been made general plant manager of all Oliver branches. He is being succeeded at South Bend by STANLEY F. KRZESZEWSKI.

♦ ♦ ♦

F. L. COYNES has been appointed manager of the Cleveland branch of Sterling Wheelbarrow Co., Milwaukee. Mr. Coynes was connected with the Chicago office for the past ten years and in his new capacity succeeds the late J. M. DICKSON.

♦ ♦ ♦

W. C. GROVE has been appointed manager of the Chicago office of the Buffalo Foundry & Machine Co., Buffalo. Mr. Grove has been with the Buffalo company 9 years and for the past 6 years has been manager of the Toronto office.

♦ ♦ ♦

W. A. NEILL has been made manager of engineering and sales at the Holyoke, Mass. plant of the Worthington Pump & Machinery Corp. Mr. Neill formerly was manager of the corporation's air tool and portable compressor division at Harrison, N. J.

♦ ♦ ♦

S. J. MORAN, formerly purchasing agent of the Union Steel Castings Co., Pittsburgh, recently has been made assistant treasurer of the organization. Mr. Moran has been connected with the Union Steel Casting Co. for the past 18 years. R. D. KENNEDY has replaced Mr. Moran as purchasing agent.

♦ ♦ ♦

W. H. SCHERER has been made manager of the Holyoke, Mass., plant of the Worthington Pump & Machinery Corp., Harrison, N. J. Mr. Scherer previously was connected with the Westinghouse Electric & Mfg. Co. and during the past 18 years was superintendent of the Westinghouse East Springfield works.

♦ ♦ ♦

WAYNE Z. FRIEND recently has been appointed to the development and research staff, International Nickel Co., New York. He will devote most of his time to technical service on corrosion resisting materials, particularly monel, nickel and inconel. Mr. Friend's experience has been principally in the petroleum and natural gas industries. He was graduated from West Virginia university in 1926, and joined the Gasoline Recovery Corp., Charleston, W. Va. During the past 7 years he has been associated with the Phillips Petroleum Co., as chief technologist, Philgas department, Detroit. Mr. Friend has been active on committees of the American Gas association, American Society for Testing Materials, and the National Bottled Gas association.

♦ ♦ ♦

ARTHUR G. MCLAUGHLIN, for the past 5 years works manager at the Springfield plant, recently has been appointed vice presidenet of the Ohio Steel Foundry Co., Lima, O. Mr. McLaughlin was born in Oil City, Pa. and has been active in steel foundry business for many years. Before coming to Ohio, he was connected with the American Steel Foundries at Indiana Harbor, Ind., and with the Hubbard Steel Foundry Co., East Chicago, Ind. Prior to his position at the Springfield plant of the Ohio Steel Foundry Co., Mr. McLaughlin was superintendent and works manager at Lima for 12 years.

♦ ♦ ♦

M. I. DORFAN, formerly manager of the dust division, Blaw-Knox Co., Pittsburgh, again has become connected with the Pangborn Corp., Hagerstown, Md., to act as general field representative under the title of dust control specialist. In addition to being a registered professional engineer in the state of Pennsylvania, Mr. Dorfan is an active member of the American Society of Mechanical Engineers, and the

M. I. Dorfan

American Society of Heating and Ventilating Engineers. He has served on several important engineering and dust committees including one of the American Standards association, which is engaged in establishing national standards of exhaust systems design. Mr. Dorfan will be located in the branch office of the Pangborn Corp., Chamber of Commerce building, Pittsburgh.

♦ ♦ ♦

GEORGE G. BENNETT, recently made superintendent, Warman Steel Casting Co., Huntington Park, Los Angeles, Calif., has had many years experience in the foundry field. From 1918 to 1923 he was coremaker and molder with the Sullivan Machinery Co., Claremont, N. H. He left that firm to become foreman and later assistant superintendent of foundries for the Jones & Laughlin Steel Corp., Pittsburgh. He remained with that firm until this year when he accepted his present position.

♦ ♦ ♦

DR. A. U. SEYBOLT recently has been appointed a member of the technical staff at Battelle Memorial institute, Columbus, O. He received a degree of doctor of philosophy at Yale university in 1936, and has been assigned to the division of

(*Concluded on page* 60)

TYPICAL COMMENTS FROM TYPICAL USERS OF MELTRITE

"It used to be from 30 to 35 minutes after we put the wind on that the first tap was ready. Now, it only takes about 20 minutes. The succeeding taps were at about 10 minute intervals and now we tap every 5 minutes. This cuts down our pouring time considerably."

● From a large jobbing foundry

. . ."they (MELTRITE PIGS) are far better to handle and on account of the fact that they spread more, the charge seems to pack better in the furnace. They also melt faster, and all in all represent quite an appreciable advantage."

● From an automobile specialties manufacturer

. . ."we undoubtedly get more even melting with these small pigs (MELTRITE) and the chances of getting oxidized iron are greatly reduced. Another advantage is that they are not so hard on a cupola lining because as the iron melts in a cupola and drops lower, heavy pigs have a tendency to score the linings in vertical grooves."

● From a stove manufacturer

. . ."we have kept an accurate check of our coke costs per ton of melt for the MELTRITE iron as compared to our former costs. Our figures indicate that we are saving 6.7% in coke costs."

● From a stoker manufacturer

. . ."we find that MELTRITE PIGS melt faster and hotter and because of their size it is possible to obtain a more even charge. Also the smaller pigs handle much easier and this, of course, is appreciated by the parties who handle the iron."

● From a pump manufacturer

. . ."we are very much pleased with your MELTRITE PIGS. We very much prefer this type of pig for handling, uniform melt, etc."

● From a furnace manufacturer

. . ."MELTRITE PIGS being lighter, enable the boys to put them in the cupola and to spread the iron more evenly in the charge. We are more than pleased with the castings as we find that they machine readily and our first loss in the foundry has been decreased."

● From a railway equipment manufacturer

. . ."MELTRITE PIG IRON is easier to handle, packs better in the furnaces and melts faster." . . . "a pretty good recommendation for this design of cast."

● From a general equipment manufacturer

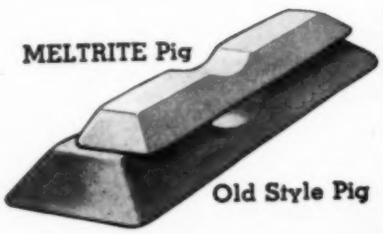
MELTRITE (TRADE-MARK) (REG. U. S. PATENT OFFICE) PATENT PENDING

AMERICAN INDUSTRY IS USING MORE AND MORE MELTRITE PIG IRON

A steadily increasing number of firms are employing MELTRITE. In hundreds of plants it has become the dominant pig iron. In scores of these it is the only pig iron used.

MELTRITE offers very definite advantages:

Easier to handle • Saves melting time • Reduces foundry losses • Produces better castings • Saves fuel and labor • Increases output.



Shown above are extracts from letters in which users tell of the advantages they derive in the use of this smaller pig. Space allows statements from only a few industries—MELTRITE is saving money and aiding quality in all industries requiring pig iron.

MELTRITE is made by the people who have pioneered in the merchant field.

PICKANDS MATHER & COMPANY

CLEVELAND • CHICAGO • DETROIT • ERIE • TOLEDO • MINNEAPOLIS • DULUTH • ST. LOUIS

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OSBORN

CORE BLOWING MACHINES

TIME PROVES VALUES

OSBORN

Cores for these typical STREAMLINE Fittings are produced on Osborn Core Blowing Machines

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A battery of No. 91-8 and No. 92 Osborn Core Blowing Machines produce cores of uniformly high quality, true to size, for accuracy of machining to maintain the smooth, uniform interiors of the world-famous STREAMLINE Fittings manufactured by the Mueller Brass Company of Port Huron, Michigan.

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A rapidly increasing number of foundries are using Osborn Core Blowing Machines to produce uniformly high quality cores at minimum cost per core. Cores of irregular shapes and a wide range of sizes come within the scope of Osborn Core Blowing Machines. Investigate the advantages of Osborn Core Blowing Machines as related to your own core requirements. Write for details.

THE OSBORN MANUFACTURING COMPANY
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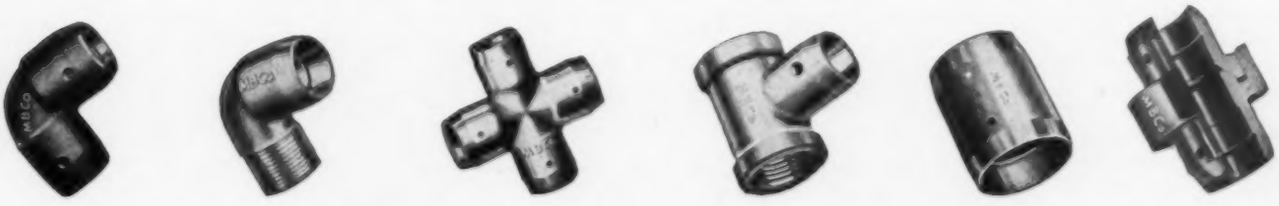
CLEVELAND, OHIO, U. S. A.

AGENCIES LOCATED IN IMPORTANT CENTERS OF THE WORLD

Cores for these typical STREAMLINE Fittings are produced on Osborn Core Blowing Machines



VIEWING FOUNDRY DEVELOPMENTS AT SHORT RANGE

PERHAPS in the future some commercial castings may be made by a process described in a recent patent. While primarily designed for dental castings, the inventor claims it can be used for other castings. The process involves induction and magnetic currents, the mold being constructed over a transformer. Induction currents melt the metal, and the magnetic force is employed to make the metal flow into the mold cavity with a greater head than can be supplied by gravity. It is claimed that delicate impressions are sharp, and the castings are much more solid than obtained by other means.

• • •

A Pacific Coast steel foundry has found that galvanizing or zinc coating of metal flasks, bands, and jackets increases their life considerably. According to the firm's experience, snap flask bands which lasted 1½ years uncoated, have had their lives extended beyond three years by galvanizing.

• • •

Nearly 200 plaques of aluminum, cast with raised letters, are being placed beside North Carolina highways to indicate places of historical interest.

• • •

At the recent A. F. A. convention and exhibition in Milwaukee one of the chaplet manufacturers displayed a wide range of tin forms, ingenious gadgets for simplifying molding operations on a wide range of castings. Catches on doors, hinges and undercut members are formed by placing these ready made tin forms on the pattern. When the pattern is removed the form remains in the mold. In other instances the form is packed with core sand and the tin sheath serves as reinforcement.

• • •

In a V-belt drive available for many industrial uses, variable speed is obtained if necessary while the machine is running by bringing the separate sides of the sheaves together or by separating them to a definite limit.

• • •

A high lead, low nickel bronze which is said to give excellent service as a seal in electrically operated refrigerators contains 28 per cent lead; 4.5 per cent tin; 0.5 per cent nickel and remainder copper.

• • •

A new soldering flux said to be soluble in water so that excess can be washed off, now is available for use on stainless steel, monel metal, copper, brass, cast iron, black sheet iron, and carbon steel. It is claimed that the flux does not give off noxious fumes when heated.

• • •

KEEL on Harold S. Vanderbilt's sloop, RANGER, which so successfully defended America's Cup against T. O. M. Sopworth's challenger, ENDEAVOR II, is cast lead, and weighs 100 tons. Approximately 6½ hours were required for pouring, and the mold was made of sand faced with graphite. The casting was left in the mold a week to insure complete solidification.

• • •

One of the leading truck manufacturers uses an alloy cast iron for cylinder blocks which has the following range: Total carbon, 2.80 to 3.30 per cent; manganese, 0.50 to 0.80 per cent; silicon, 1.75 to 2.25 per cent; nickel, 1.50 to 1.75 per cent, and chromium, 0.50 to 0.75 per cent. The blocks are heat treated to relieve stresses. Tensile strength of the iron ranges from 38,000 to 40,000 pounds per square inch, the average brinell hardness is 229, and it is readily machinable.

• • •

A METHOD of preventing formation of undesirable carbides, particularly chromium carbides in corrosion resistant steels, such as the 18 per cent chromium-8 per cent nickel variety is described in a recent patent. While several elements can be used for the purpose, titanium is selected because of its strong carbide forming properties. Essentially the process consists in melting the steel under the usual oxidizing slag, and when the melt is free of carbon, that is removed. Then the bath is covered with a mixture of burnt lime, and either titanium oxide or rutile. As soon as that slag is fluid, small additions of a mixture of 2 1/3 parts of titanium oxide, 1 part of aluminum and 1 part of lime are made. The amount of titanium to be added is based on the carbon content in the melt.

• • •

In a prominent midwestern gray iron foundry clean cylinder sleeves are produced through a method of gating whereby the metal flows to the bottom of the mold through a central sprue in the core. A dry sand ring core at the bottom contains four lateral passages 90 degrees apart terminating in four short upright gates leading to the mold cavity. The molds are made in green sand, four in a flask.

ADVERTISING PAGES REMOVED

Plywood Used In Patternmaking

BUILDING up laminations of wood always has been practiced in the patternmaking trade. In so reconstructing the wood one of the basic principles of plywood engineering was demonstrated and recognized. Adjacent layers of wood are glued with the grain running at right angles to overcome the inherent tendency of the wood to swell and shrink with changes in its moisture content. In many instances this reconstructing of pattern stock involves expensive hand labor. However, for several years a material, factory made and of quite reasonable cost, and claimed to have certain valuable qualities has been on the market. The material is Douglas fir plywood, a staple material in many industries, but a comparative new-comer in the foundry.

Economy in Pattern Shop

In the Atlas Foundry & Machine Co. plant at Tacoma, Wash. due attention is given to the major factors, metal, equipment, etc., but diligent effort also has been applied in increasing efficiency and lowering material costs, for example, by keeping the pattern and flask shop in step with the newer trends in the other departments.

The Atlas foundry, located in Tacoma, the heart of the greatest timber region in the world, has a wide choice of woods and the services of scores of trained wood technologists. Located also in the center of plywood production it is only natural that this firm should pioneer in the use of that particular wood product.

Early experiments with plywood for pattern stock demonstrated that it was adaptable for the purpose without change in regular practice. Absence of warp and twist of large panels, sometimes several feet in length and width, proved its adaptability to a wide range of pattern uses. Douglas fir is somewhat harder and of more pronounced grain than cork pine, which may be used in conjunction with it for fine detail work, yet it readily may be worked with hand tools. It is claimed to have excellent nail-holding power and an affinity for all types of glue. Use of the plywood as the base pattern, to which features of other materials have been applied with both nails and glue, is shown in Fig. 3.

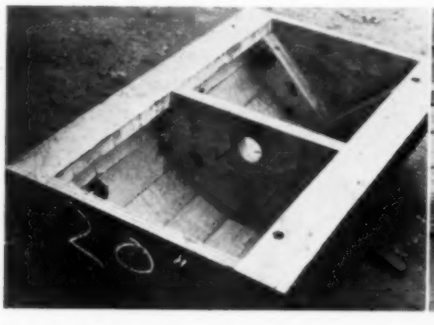
Used for Many Purposes

Experiments have proved plywood satisfactory, not only for pattern stock and mold boards, but also for a number of other uses in connection with patternmaking. For certain structural features of various types of patterns it is valuable. For example, the supports in the half cylinder pattern, Fig. 1, are of plywood. That material, tougher because of the laminations of crossbands, is designed to withstand severe usage. This characteristic of toughness is advantageous, particularly in patterns re-used many times. It has been found that plywood is not destroyed by rapping on the bare wood nor are the drawing or rapping plates loosened when they are used.

Plywood has been used as sheet templates by the Atlas Foundry & Machine Co. The plywood submitted to fast and rough handling but was dependable from the standpoint of accuracy. Plywood also is used in that foundry in the construction of flasks and cribs.

The Atlas Foundry & Machine Co. operates one of the largest shops in the Pacific Northwest. M. G. Tennent is vice president and manager and A. B. Bowman is pattern and flask shop foreman.

Fig. 3—Plywood used as base material on large patterns



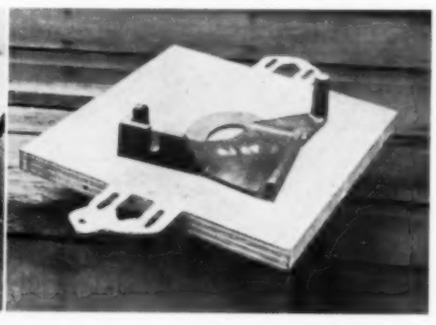


Fig. 1 (Left)—Braces and supports on large cylinder pattern made of plywood. Fig. 2 (Right)—Claimed to be excellent for mold boards

Will Open Office In Detroit

Mathews Conveyer Co., Ellwood City, Pa., will open a sales engineering office in the Curtis building, 2842 West Grand boulevard, Detroit. C. E. Jeremais and E. A. Smith, as field engineers, will be in charge. In addition, sub-agents are being located throughout the state to supplement the facilities of the Detroit headquarters. This new arrangement will replace a previous one whereby the Palmer-Bee Co., Detroit, represented the Mathews company in the state of Michigan.

Issues Booklet on Hard Facing

A new and more complete edition of the booklet "Hard Facing with Haynes Stellite Products" has been published by the Haynes Stellite Co., Kokomo, Ind. The booklet contains 104 pages and describes over 500 applications of the hard facing process. In addition, hard facing procedure for different examples is described. New sections in the booklet deal with the firm's cutting tools and corrosion resistant alloys.

Barnum never saw a sight like this

The Adventures of Bill

—by Pat Dwyer

EVERY once in a while," said Bill, "a more or less vague term, but sufficiently accurate for all present purposes, I hear a program on the radio that meets my undivided attention and earns my whole hearted approval. I suppose to be consistent I should write to the performer or performers and notify him, her or them to that effect. In a general way I have gathered that this practice is quite common. Up to the present I have neglected to take the trusty quill in hand to deliver this well merited pat on the back. Pressed into a corner I could present at least 47 good reasons for this apparent lying down on the job, but three will do for the present.

"First, I have seen statements covering the—to me—fabulous remuneration received—I almost said earned—by these artists. They are in no need of approbation, approval or a pat on the back. Second, I have seen pictures of our popular idols dressed in easy neglige, seated on a raised dais or reclining on a chaise longue entirely surrounded to a depth of approximately 2 feet 6 inches with the morning fan mail. No human being possibly could wade through that mass of correspondence in a day even if each letter merely contained the usual, 'Hello Toots. I think you're swell,' or 'lousy'—always bound to be a few malcontents, poison worms in the syrup, gad flys in the honey—'Good bye.'

"Assuming that the letters actually are opened and read by a flock of secretaries. Well, suppose they are? The writers, are still left behind the 8-ball. The secretaries open a few dozen selected at random, glance at the signature and then throw them on the remaining pile with instructions to the janitor to shovel the mess into the garbage wagon or the incinerator. No. 1 man and his aides delicately stifle individual yawns, decide to call it a day and saunter off for the usual hourly dip in the swimming pool. I may be old fashioned, but when I toil and sweat over a letter, telling a man what I think of him, applying what is vulgarly known as the baloney in liberal gobs, or taking the hide off, one narrow strip at a time, I like to have reasonable assurance that the addressee will see it.

"The third and probably most important reason is that I hate to write letters to people I do not know. For example consider the salutation. Dear Mr. Bumbo infers a degree of familiarity not justified by our position as total strangers. Dear Sir is almost as bad and certainly is not the way you would address a man if you met him face to face. The single grumpy, abrupt Sir at the beginning of a letter seems to say, 'Look out fellow, here's where I bop you one!' It is bound to arouse antagonism, even subconsciously, and the reader is prejudiced against you even before he reads the letter.

He can be pushed just so far

"Obviously the foregoing applies with even greater force in the various forms of salutation when addressing a lady. Members of this section of the human family can extract more hidden meanings from words than a cross word puzzle addict can find in an encyclopedia. She may be known to millions of radio fans as Aileen, Kate or Mary. Old Keough the Piper might address her familiarly as Aileen Allanna, Kitty Darlin,' or Mary Acushla, but there is just a chance she might have her lawyer write you a few pertinent words if you were to address her as My Dear Mary.

"You may claim that laziness and not discretion or a nice sense of propriety is responsible for my lack of activity with the quill. Oh, well. This is a free country where every man is entitled to his opinion. If he is satisfied to wallow in ignorance, far be it from me to drag him out with a cant hook or peavy.

"Coming now to the other side of the question, usually prefaced by writers and speakers with the statement, 'On the other hand'—silly of course and all that jolly old tosh, but who is going to throw the first stone?—on the other hand I hear programs on the radio that, to put it mildly, exceed my endurance limit. Singularly enough, certain other members of the family hail these horrible vocal musical and literary monstrosities with delight.

"One in particular, a serial covering the moronic activities of a family, each member of which speaks with a different accent, on more than one occasion has driven me out of the house biting my nails and muttering to myself. This system of orderly withdrawal presents

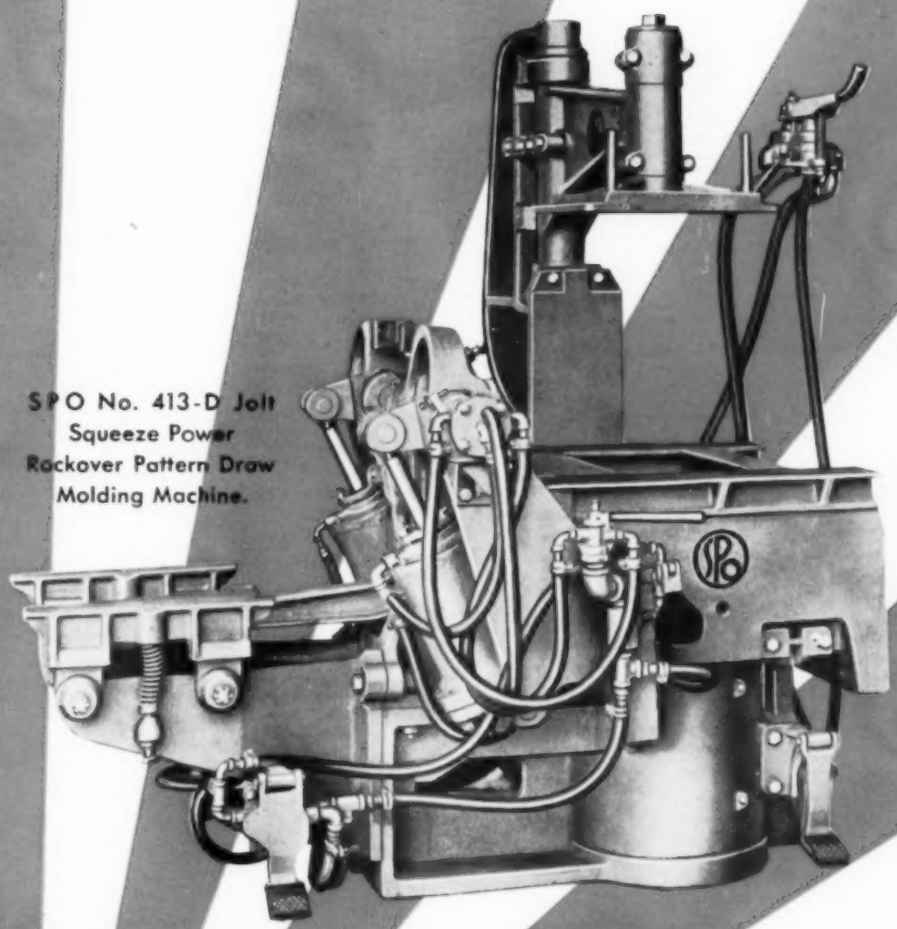
(*Continued on page* 54)

A BETTER & EASIER WAY

to make Molds is on

Molding Machines

built by SPO, *Inc.*



SPO No. 413-D Jolt
Squeeze Power
Rockover Pattern Draw
Molding Machine.

Entirely
air-operated.

Cuts manual labor
down to a minimum.

Incorporated

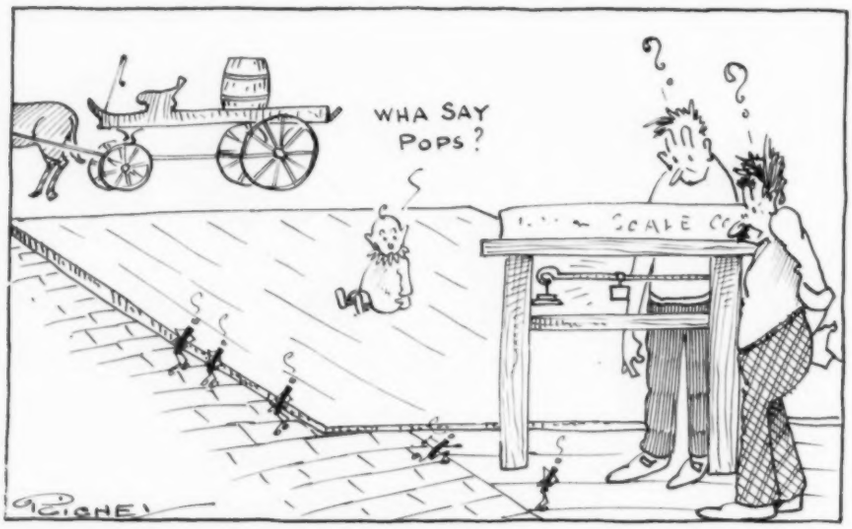
Manufacturers of a complete line of Molding Machines and Vibrators

East 61st and Waterman Ave. • CLEVELAND, OHIO

(*Continued from page* 52)

no hardship in the summer season, but unless the sponsor takes the program and buries it in the ash dump—a highly improbably supposition—I shall have to hunt up a haven of refuge for at least one night every week during the coming winter. 'Twould be just my luck to pick out a place of that kind and then discover a radio next door blaring out the same old tripe.

"For the past few months, on the appointed night, I beat the announcer to the draw. With the opening sentence I am up and away like a jack rabbit, through the back door, across the yard and into the garage where as you will kindly note I have rigged a bench for just such emergencies. Comparison to a jack rabbit may be slightly overdrawn, but you get the general idea."



As the absent minded butcher said "20 pounds, Madam—with the bones!"

"Well, well," I said, "and so here you are. The farmer in the dell. Hy-ho the merrio, the hermit in his cell! Just goes to show that I am in the pink when poetry oozes out spontaneously like honey through the bottom of a beehive, like sap from the old maple tree, like the pure bubbling rill—"

"I know. I know." Apparently the old boy was on the prod. "Like the drop on the end of your nose. The drip in the bottom of a silo or the stuff that oozes through the tent and runs down the back of your neck when camping. Ooze in here, take a load off your feet and leave poetry to the birds who know how many feet should go in a line."

"I thought I should find you in here," I remarked placidy, "I looked in at the front door, but when I heard the line of chatter spouting from the radio, I knew you would be as far away as possible. I also knew I should find you bristling like a porcupine and about as companionable as a badger afflicted with fallen arches and acute indigestion. True I never actually have seen a badger afflicted in this manner and it is quite possible that a beneficent providence protects them from the ravages of these diseases. You know the Lord tempers the wind to the shorn lamb and all that kind of stuff. However, no great effort of the imagination is required to picture a badger, a cantankerous brute under the most favorable circumstances, suffering with flat feet and acute indigestion. To relieve the tension along comes winsome Willie who tosses a small but fragrant poetic bouquet in your direction and what does he get? A verbal poke in the snoot, no less. Lend me a match and a pinch of tobacco and I'll sit here while you simmer down from the boiling point to a more or less normal temperature."

We smoked the pipe of peace while the languorous dusk of a summer night settled on the neighborhood. Presently the street lights flared among the trees, brilliant blossoms in an area of green supplemented by lesser and more subdued lights streaming through windows near and far. The silence was punctuated occasionally by the subdued roar of a trolley car climbing an adjacent hill and the equally subdued blast from a Pennsylvania locomotive, tearing out of town far away to the south and bellowing imperiously for right of way at the crossings.

Toned down by distance the screaming whistle that lifts the hair on the heads of bystanders came to our ears almost as gently as the late Mr. Tennyson's horns of elf land faintly blowing, or as Bill inelegantly put it like the last sad wail of a banshee crouched all night in a nest of thistles or nettles in a corner of the churchyard. Pressed for details he admitted he never actually had heard one of these yowlers. One reason was that he kept as far away as possible from churchyards at night. Another was that in his young days he burrowed under the pillows at night like one of these here now prairie dogs vanishing down a hole when he has reason to suspect dirty work at the cross roads.

However, his father and grandfather, men mark you, of the most unblemished reputation and highest integrity—and he would be greatly pleased to knock the block off any person who so much as lifted an eyebrow in doubt of this claim—his father and grandfather on more than one occasion had seen and heard the banshee. What further and more convincing evidence could any reasonable person expect than that?

I hastily admitted the justice of his claim. Even in a court of law where things are not always what they seem, the testimony of actual eye witnesses carries considerable weight.

"Talking about weight," said Bill, "I witnessed a rather curious incident recently. While in a town on the river above Detroit I heard of a lad who runs a foundry there all by himself. He is the whole works, molder, coremaker, cupola man, tapper out and botter up, ladle man, salesman, purchasing agent, carpenter, maintenance man, chemist, metallurgist—"

"Ah," I interrupted, "A modern version of the crew and the captain bold and the mate of the Nancy brig, the bosun tight and the midshipmite and the crew of the Captain's gig!"

"Never heard of him. You must be thinking of two other fellas. Back in the old days I had heard of instances where a man ran a shop all by himself with perhaps the help of a husky young neighbor to carry the single end of a shank when pouring off, but of late years this particular type of hero apparently has passed out of existence with that other once familiar figure the hobo molder. I wonder what has become of all the old knights of the road?"

"Probably gone with the wind," I suggested. "Most of the old boys were pretty windy. Carry on. What about this lad who like Horatius held the bridge in the brave days of old?"

"Horatius what? Was he one of the gang on the bridge of the Nancy brig? What's the idea of dragging in this sea faring stuff? In a show down I don't believe you know the difference between a brig, a barquentine and the leg-o'mutton

(*Concluded on page* 57)

ADVERTISING PAGES REMOVED

(*Concluded from page* 54)

sail galley manned by the fierce old Salle rovers in the days of Robinson Crusoe. Pipe down, stow the gab me bully boy, 'till I shoot the sun and see where we're at."

"Aye, aye Sir!"

"This lad I am telling you about leads what I consider the ideal form of existence, almost as perfect as that of Bobbie Burns' cat. Ye'll mind the lines," Bill dropped into what he considers a fair example of the Doric, "which Rab addressed ta the owd tom cat sleepin' on the hearth: 'Hoo Ah envy ye, ye scut. Na bills ta pay, na lines to write. Sleep a' day an' prowl a' nicht!' This master molder up the river does not sleep all day, neither does he prowl all night, but he could if he felt so inclined and that is practically the same thing. He works when he has castings to make and when he has no castings to make he goes down to the river and catches a mess of fish and watches the big ore boats and all other manner of craft with the possible exception of battleships, pass in endless procession. He knows men on many of the craft and they exchange greetings and one thing and another.

"He is a sociable kind of a fella and the neighbors often drop into his shop, much as they did in the old days when the village blacksmith kept open house under the wide spreading chestnut tree. They also find use occasionally for a 5-ton floor scale. The day I was there, a young father came in with a baby 3 or 4 months old in a carriage. He solemnly wheeled the carriage on the scale and balanced the weight to a nicety. Then the foundryman obligingly held the baby while the father weighed the carriage. By deducting the tare from the gross weight, the two mathematicians gravely arrived at the net or true weight of the baby. Very touching. One of the most beautiful things I ever saw."

"Probably inherited," I said, "Your grandfather also had quite a gift for seeing things."

Casting Small Aluminum Rotors

SEVERAL steps in the production of cast rotors for squirrel cage motors as practiced at a plant of the Reliance Electric & Engineering Co., Cleveland, are shown in the accompanying illustrations. The rotor bars, short-circuiting rings and fans form a one piece aluminum casting. In the first step, laminations are stacked on a mandrel provided with a skewed key which automatically guides the disks into position with the proper skew. The assembled mold and cores are preheated to a temperature of about 400 degrees Fahr., in preparation for the casting operation.

The core is assembled in a three section mold. The bottom section is solid except for a series of small openings or gates. The other sections form the short-circuiting rings and fans. Before casting, the length of the core is measured while it is under pressure. The casting press is air operated, having two cylinders in line vertically, each with its own pressure tank. Air is maintained at a pressure of 100 pounds per square inch.

As shown in Fig. 1, the required amount of aluminum at a temperature of 1300 degrees Fahr., is poured from a hand ladle into an asbestos lined chamber over the lower cylinder of the press. The mold then is placed in position over the molten metal which under a pressure of several tons is forced up through the gates into the molds and slots in the laminated core.

After the casting operation occupying about 5 seconds is over the mold is removed, laid on its side and the metal below the gated section is sheared off. The upper and lower rings then are removed as shown in Fig. 2. The assembly is placed under a hand operated rack and gear press which removes the mandrel from the center and broaches a straight keyway in the core as shown in Fig. 3 at the right in the illustration.

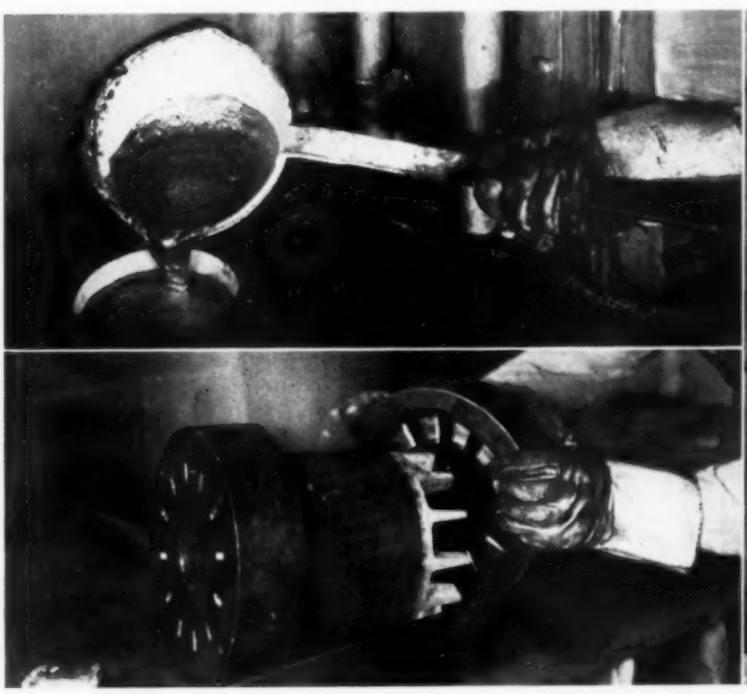


Fig. 1 (Above)—Molten aluminum is poured into an asbestos lined chamber above the lower cylinder. Fig. 2 (Below)—Extra metal and gates are sheared from the bottom of the lower ring. Fig. 3 (Right)—Top and bottom ring molds at right and left. Mandrel is pushed from center of one piece casting under a press

Sea Coal in the Foundry

By R. W. METCALF
Nonmetal Economic Division
U. S. Bureau of Mines, Washington

SEA coal is known locally by various names, mineral facing, coal dust, ground coal, bolted coal, etc. The term sea coal originated from the fact that the coal was shipped by sea and mined from workings that extended under the sea. Under any of the various names, the coal preferred for foundry facing is a high grade gas coal, although under certain conditions low volatile coal and anthracite culm have been used for the same purpose.

The Youghiogheny gas coal belt, Westmoreland county, Pa., for many years has been a sea coal production center. Many large dealers and suppliers maintain grinding and pulverizing mills there. Coal from near Farmington, Northern W. Va., also has been used. Middle west consumers are supplied from West Virginia and Kentucky. Many large consumers prepare their own sea coal, in many instances abstracting a certain amount from fuel pulverizing systems. Where individual grinding units are installed, the coal is the same as that purchased for steam generation.

Large Annual Consumption

No statistics are available on the consumption of sea coal in the foundry industry. Sales by merchant grinders are estimated at about 50,000 tons in a normal year, with possibly an equal amount prepared by large foundries for their own use.

Analyses of commercial grades reflect the preference for coal of high volatile, low sulphur, and reasonably low ash content. Volatile matter apparently ranges from 25 to 40 per cent, 30 to 34 per cent being a fair average. One plant specifies a minimum of 32 per cent volatile matter. Fixed carbon usually varies from 56 to 65 per cent. One specification calls for between 60 and 75 per cent with a minimum of 55 per cent, whereas another merely requires that the total carbon shall be above 90 per cent.

With respect to sulphur, one supplier indicates 2 per cent as the maximum, but the usual figure appears to be between 1 and 1.50 per cent, while less than 1 per cent is preferred. A number of analyses indicate a preference for coal with an ash content of less than 6 per cent. The usual maximum limits are 6 to 10 per cent, occasionally 12 per cent and in one case 13 per cent. Moisture content, where specified, generally is limited to less than 1.25 or 1.50 per cent.

Degree of pulverization varies considerably with the kind of castings to be made. Coarser grades of sea coal are used for heavy gray iron castings; medium and fine grades for medium gray iron and malleable iron. The finest grades, including what is known as air floated are used on light, ornamental work. However, by some authorities[1] an air floated product is considered to be inferior in actual use to slightly less finely ground material.

Specifications Vary

There seems to be no uniform method of classifying the various sizes of coal dust. Some manufacturers designate only the largest opening through which all the material will pass. Others indicate both the percentage that remains on a given screen and what will pass through. Still others use an arbitrary fineness number without indicating any percentage distribution of sizes. For example, one commonly used set of specifications is as follows:

Size		100 per cent through
A	.....	No. 12 mesh screen
B	.....	No. 18 mesh screen
C	.....	No. 24 mesh screen
D	.....	No. 40 mesh screen
E	.....	No. 100 mesh screen

Another group of suppliers orients sizes with reference to a 150-mesh screen as follows:

	Per cent through 150-mesh	
Grade	Not less than	Not more than
C	35	45
D	55	65
E	75	90
F	90	

According to Hanley[2] fineness numbers of grades widely used are 128, 142, 189, 272 and a still finer grade known as *air floated*. Other specifications given by suppliers and consumers of sea coal include:

1—75 per cent through 100 mesh.
2—Over 80 per cent through 200-mesh.
3—Not over 1 per cent on 20-mesh; not over 20 per cent on 100-mesh; not less than 60 per cent through 100-mesh.
4—0.5 per cent on 60-mesh; 11.8 per cent through 60 and on 100-mesh; 27.0 per cent through 100 and on 200-mesh; 60.0 per cent through 200-mesh.

Shipments to consumers are made in paper bags, sometimes water proof; double or multiple walled burlap or jute bage, either plain or paper lined; and in paper lined barrels. Filled paper bags weigh from 50 to 100 pounds; while jute bags either plain or paper lined weigh from 100 to 150 pounds. A barrel usually contains from 300 to 350 pounds. Occasionally 200-pound barrels are specified.

Paper or jute bags are used most frequently in shipping sea coal. However, because of greater cleanliness, the interstate commerce commission has recommended the use of paper lined jute bags, which undoubtedly are safer and more convenient for shipping purposes. One disadvantage is that sea coal packed in paper lined jute bags stored under cover for long periods without natural ventilation, apparently is more liable to spontaneous combustion than when stored in plain jute bags.

Effect of Sea Coal

Sea coal is added to the facing sand to produce a clean, smooth surface on the casting. Disadvantages include tendency to decrease bond and permeability in the walls of the mold, with consequently greater possibility of defects in the casting.

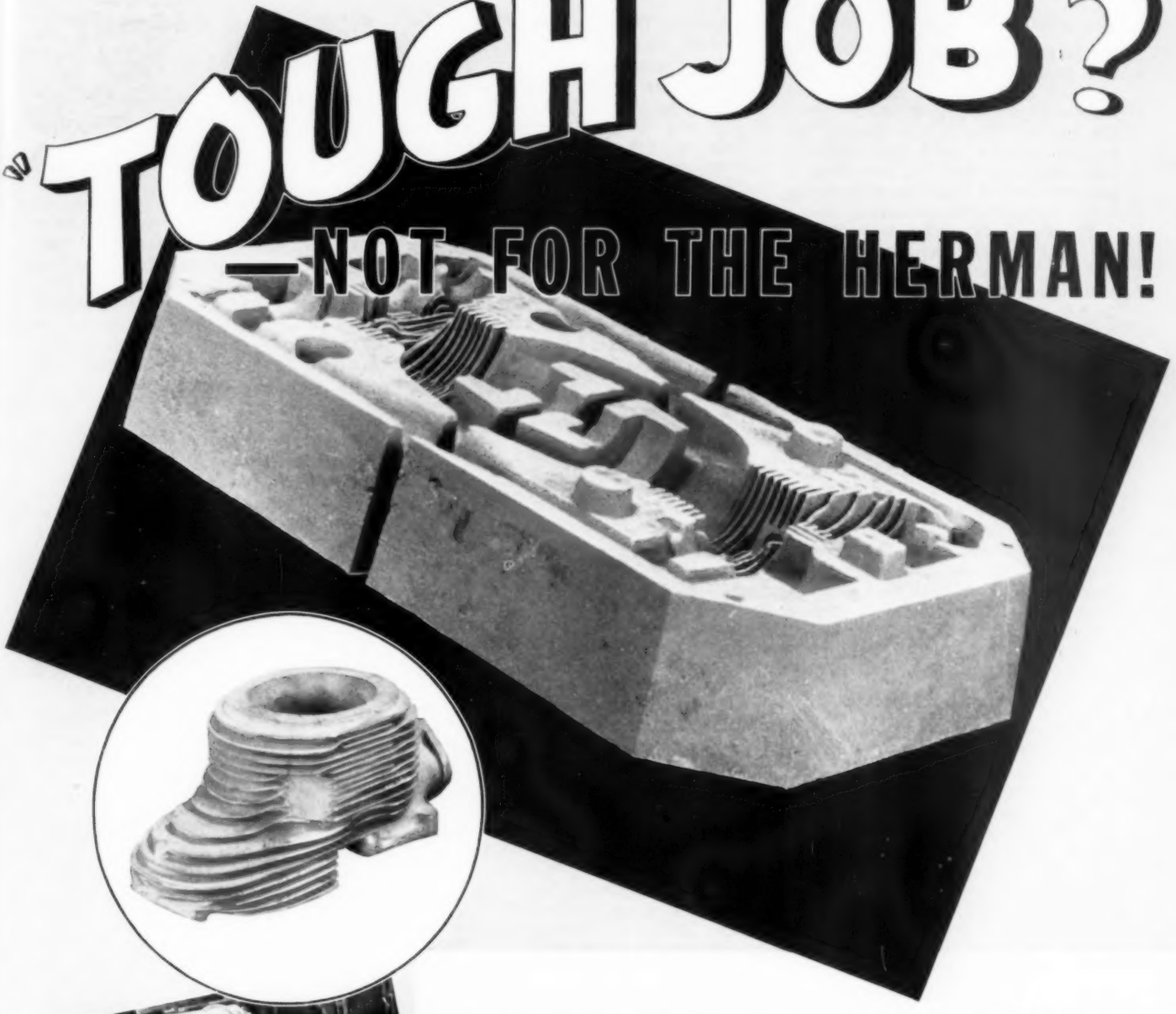
Effect of sea coal in the mold appears to be as follows: As the hot metal is poured into the mold, the heat radiated causes the coal dust particles in the facing sand to give off volatile matter in the form of gas, which during combustion, produces some smoke. Part of the carbon present in the smoke is deposited on the face of the mold as a thin coating which tends to act as a protective shield, preventing the molten material from cutting into the sand.

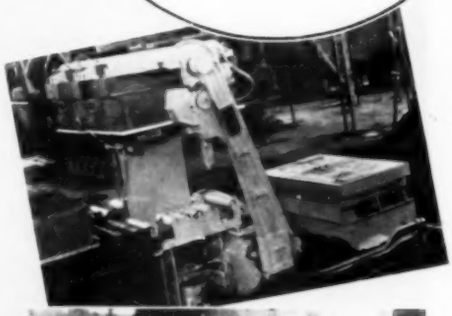
Where the heat is intense, particularly with heavy castings, the sand is not sufficiently refractory to withstand the high temperatures evolved. The addition of finely ground coal dust provides the needed resistance. The gas thrown off by the coal forms a cushion or pad between the advancing metal and

(*Concluded on Page* 60)

"TOUGH JOB?"

—NOT FOR THE HERMAN!





ACCURACY in drawing is insured by the hydraulic action of the New Herman. (Top Illustration)

SPEED—instant clamping and unclamping, mold deposited directly on conveyor, plus automatic timing of jarring operation insure *increased production.*

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A difficult molding job, airplane engine cylinders, made easy by using Hermans.

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Quality and *speed* are assured by these features of the new Herman.

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Call in a Herman representative today and have him explain how. No obligation.

HERMAN PNEUMATIC MACHINE CO.

PITTSBURGH, PA.

(*Concluded from Page* 58)

the face of the mold. This effect and the deposition of carbon on that part of the mold in contact with the metal, for a long time have been thought to take place during the pouring of the mold. The work of Saunders[3] and Hird[4] on the effect of sea coal on the behavior of molding sands supports this theory.

By embedding mica windows in the walls of experimental molds, and cutting away that part of the mold back of the windows, Hird had an unusual opportunity to see what actually happened during the pouring of a metal casting. He noted that the molten metal advanced with a surface higher in the center than at the sides. Upon contact of the hot metal with the coal dust particles in the facing sand, there arose immediately a cloud of smoke. Amount and density of this smoke, Hird found, is directly proportionate to the amount of coal dust in the facing sand and the volatile matter in the coal. By using facing mixtures with and without sea coal, the action of the smoke in depositing a thin layer of carbon in front of the advancing metal could be observed and recorded clearly.

Tests on Thin Plates

Tests were made on thin plates with different proportions of sea coal in sand and with coals of varying volatile content. An anthracite, a low volatile coal, and one slightly over 30 per cent in volatile content were used. Fineness respectively was 40, 28 and 12 (40, 28 and 12-mesh per linear inch sieve) for each of three percentages of coal dust to sand 30, 15 and 5.

Tests on heavy castings then were carried out with high volatile coal only. The fineness sizes were the same as in the other experiments, but for each grade results were noted carefully for four different proportions of coal dust to sand—30, 15, 10 and 5 per cent.

Best results were obtained with a facing composed of sand and coal dust in the proportion of about 10 to 1, the coal being bituminous with a volatile content over 30 per cent. Fine coal dust (through at least a 40-mesh sieve) is the most efficient for both heavy and light castings.

Many large British consumers and dealers were accustomed to use or to furnish coal dust somewhat finer than those employed in Hird's experiments.

Coarse mixtures do not protect the face of the mold sufficiently. They leave many of the sand grains without a carbon shield, thereby rendering the mold face liable to serious damage. Too much coarse coal dust produces pock marks, unsightly pits and eruptions on the face of the casting. Too much fine coal dust cause what is known as *mapping*, thin irregular fins on the surface of the casting.

Proportion and fineness of sea coal in the facing sand varies with the class of castings to be made, size and weight, thickness of section and the character of the sand, whether fine or coarse. According to American authorities the maximum for heavy work is 1 part sea coal to 5 parts sand. This proportion decreases to about 1 part sea coal to 20 parts sand for light castings, cotton machinery, fine tooth gears, ornamental castings, etc. Mixtures containing 1 part sea coal in 10 to 15 parts sand are employed most commonly.

Grain Size Important

For light castings of intricate design, finely ground and bolted material is best. This fine grade also is well suited for medium castings. For larger and heavier castings proportionately more sea coal of a coarser grade should be used. For best results it is desirable that sand and coal be of the same approximate fineness, to allow the escape of gases from and through the mold as readily as possible. Should either coal or sand be much finer than the other, the minute air spaces between particles would tend to become filled with the smaller material and thus impede the free passage of gases to the outside surface of the mold. For castings less than ½ or ¼-inch, no sea coal is necessary in many instances.

Certain defects in castings generally are attributed to the use of either too small or too large proportions of sea coal. Too much coal in the facing sand means more gas thrown off, less ability to handle this increased amount of gas because of a decided reduction in the permeability of the sand, and a material reduction in bond. Too little coal allows the metal to burn into the sand, producing unsightly scars on the surface of the casting.

Published by permission of the director, United States bureau of mines.

[1] Hanley, H. B., Discussion of B. M. Hird's paper "Coal Dust as Applied to Moulding Sand," presented before International Foundrymen's congress, 1929, London, England. Reported in *Foundry Trade Journal*, London, Vol. 41, Aug. 22, 1929, page 139.

[2] Hanley, H. B. Same source as former citation.

[3] Saunders, W. M., and Saunders W. M. Jr., "Effect of Heat on the Permeability of Sea Coal Facing Sands and Core Sand Mixtures." Paper presented at the 1931 convention American Foundrymen's association, Chicago. Reported in abstract in THE FOUNDRY, Jan. 15, 1932, pp. 29-30.

[4] Hird, B. M., "Coal Dust as Applied To Moulding Sand"; *Foundry Trade Journal*, London, Vol. 40, June 27, 1929, pp. 493-96; also Vol. 41, July 4, 1929, pp. 5-8. Discussions Vol. 41, Aug. 22, 1929, p. 12 and pp. 139-142.

Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, has moved its Buffalo sales and service branch to 128 West Chippewa street, Buffalo.

Men of Industry

(*Concluded from Page* 44)

nonferrous metallurgy where he will be engaged in work on copper-base and lead-base alloys.

Battelle Memorial institute also has appointed RUSSELL H. LAUDERDALE, University of Minnesota, as research associate in physical metallurgy; CARL R. BLOMQUIST, University of North Dakota, as an associate in ore concentration; ROBERT P. GRAHAM, University of Washington, as research associate in ceramics, and JOHN E. DORN, University of Minnesota, as research associate in metallurgy.

♦ ♦ ♦

JOHN J. DUGGAN, formerly treasurer, Chapman Valve Mfg. Co., Indian Orchard, Mass., recently was elected president of that organization, succeeding the late THOMAS F. MAHER. Mr. Duggan has been with the Chapman company since graduating from high school about 30 years ago. After working in various clerical departments, he entered the sales department and in 1919 was elected treasurer to succeed the late RALPH W. WRIGHT. He is also a director of the company.

FREDERICK C. LOWE, office manager of the Chapman Valve Mfg. Co. was elected to fill the post of treasurer. Mr. Lowe has been with that organization for 32 years, first having been employed in the foundry. During the past 20 years he has held several important posts, including the managership of production of both the cost department and the office.

♦ ♦ ♦

CHARLES E. FOUHY, formerly president, Industrial Management association, Elmira, N. Y., has joined the staff of the Personnel Training division, International Correspondence Schools, Scranton, Pa., as industrial co-ordinator. He has specialized in employment, personnel industrial relations and training in industry for over 20 years. In his new position Mr. Fouhy will assist in planning and launching apprenticeship programs which will co-ordinate trade practice in shops with the school's technical instruction. He has been a member of the advisory committee representing the industrialists of Elmira co-operating with the board of education of that city in the development of a new program of vocational education. He also has served as a member of the industrial relations committee of the Associated Industries, New York.

Sabin Engineering Co., Euclid Sixty-first building, Cleveland, has been appointed representative in that territory for the American Engineering Co., Philadelphia, manufacturers of stokers and hoists.

ADVERTISING PAGES REMOVED

European Foundry Practice

Digest of Recent Literature Covering Various Phases of Castings Manufacture

Nitrogen Hardening

Some Experiments on the Influence of Silicon, Phosphorus, and Manganese on Nitrogen-Hardening Cast Iron, by J. E. Hurst, *Foundry Trade Journal*, London, England, April 29, 1937.

The author carried on experimental work on several different series of nitriding cast irons to determine the effect of silicon, phosphorus and manganese. In the silicon experiments one set had a low carbon content of 1.75 per cent, and chromium contents of 1.75 per cent, 2.25 per cent and 2.75 per cent. The other had a total carbon content of 2.25 per cent with similar chromium contents, and the silicon in both varied from 2 to 5 per cent. In the phosphorus and manganese experiments the composition of iron used was that of the standard alloy used for nitrogen hardening containing about 2.50 to 2.60 per cent total carbon, 2.45 to 2.70 per cent silicon, 1..50 to 1.55 per cent chromium, and 1.35 to 1.40 per cent aluminum. In one the phosphorus varied from 0.10 to 1.36 per cent, and in the other the manganese varied from 0.60 to 2.11 per cent.

Results obtained led to conclusions that variation in silicon con tent has no effect on degree of surface hardening, but does appear to effect depth of penetration; the higher the silicon the lower the depth. Effect of chromium is in the direction of insuring greater depth of penetration rather than affecting degree of surface hardening. Phosphorus in excess of 0.20 per cent reduces surface hardening but does not alter depth of penetration. Manganese appears to be without effect on either hardness or depth of penetration.

In the case of the silicon experiments hardening temperatures of 500, 550 and 600 degrees Cent. were studied, and it was found that the highest and most uniform hardness results were obtained at 550 degrees Cent., and that depth of penetration increased with increase in temperature. Magnitude of growth increased likewise with increase of hardening temperature, and the growth seems to be independent of the depth of penetration, and also unaffected by silicon and chromium contents. Growth at 600 degrees Cent. was of a visibly substantial order accompanied by swelling and cracking at corners and edges of specimens. Case obtained at that temperature was extremely brittle and friable.

Wear Resistance

Wear Resisting Cast Irons (Les Moulages en Fonte Resistant a l'Usure), by Tony Boissaux, *La Fonte*, bulletin of the French bureau of foundry research, Paris, September-December, 1936.

A brief description is given of ways in which castings can be subjected to wear, and of laboratory apparatus for wear measurement. However, the only conclusive method of determining resistance to wear is under service conditions, or in apparatus constructed to simulate those conditions. Factors that influence cast iron from the standpoint of wear resistance are: Chemical composition, hardness, structure, homogeneity, ductility, load and relative speed of the surfaces under friction, and length of travel, nature of lubricant, and the degree of polish on the surfaces under friction.

The author then describes various types of cast iron based on the structure, and methods of changing it by nitriding, heat treatment, etc. He arrives at the following conclusions: Irons with a high carbon content should be chosen for castings which must have a high degree of hardness. Irons with a relatively small proportion of carbon should be utilized for castings which must have good mechanical characteristics as well as hardness. Special alloy irons combine the properties of both high-carbon irons from the viewpoint of hardness, and low-carbon irons from the viewpoint of machinability. Irons with a cementite-martensite structure tend to replace other irons for the manufacture of wear resisting castings. Interesting applications for those irons are: Sheet rolls, finishing rolls, cold rolls for strip, crushers, parts of conveyors used in transporting abrasive materials, etc.

Cites Progress

Metallurgical Evolution in Foundry Practice (L' Evolution Metallurgique de la Fonderie), by Prof. A. Portevin. *La Fonderie Belge*, Liege, Belgium, October, 1936.

The author reviews his subject from composition of the metal and of the mixture charged into the furnace; conditions under which the metal is melted; conditions under which the metal is poured and solidifies; heat-treatment; control during manufacture and checking of the finished product.

(1) The composition of the mixture must be known as precisely as possible by chemical analysis extending to the detection and measurement of impurities. All well-equipped foundries have their own laboratories and standard methods of analysis have been developed. Additions of various metals and alloys are now being made under control, and mention is made of the great strides that have been effected, particularly in America, in manufacturing alloy steel castings.

Various means, physical as well as chemical, also have been devised to eliminate certain elements that play a detrimental part in the melting process. Various fluxes also have been developed which neutralize the effects of certain detrimental elements.

(2) The conditions under which metals are melted are considered from the temperature to be reached and the degree of precision obtainable in reaching it; the rate of melting; the chemical alterations during melting due to the atmosphere, the fuel and the contact with the furnace linings; the pressure of solidification; the obtaining of an homogeneous mixture.

Among recent developments are the method of melting *in vacuo;* or in an atmosphere of rare gases; the correct analysis for furnace linings, the coating of elements of addition and the control of the size of the pieces or grains of such elements; the methods of agitating the bath; also centrifugal casting methods.

(3) Factors governing pouring and solidification are very important. A table summarizes such fac-

tors and another one lists various other foundry properties, defects and factors. The aim generally is to obtain a fine and compact structure. Agitation of the bath during solidification, and the introduction of "germs" in the form of solid pieces of metal of chosen size, are resorted to. Control of the rate of cooling can also be effected.

To avoid certain defects, molding sand must be controlled, and great steps have been made in that direction. Experiments have also been made in casting under pressure to avoid the defects arising from the liberation of included gases.

(4) Great strides have been made in the development of the heat-treatment of iron castings. Considerable experience has been acquired from the technique used in steel-casting. Light alloy castings also are subjected to heat-treatment. Progress has also been made in the heat-treatment of malleable iron by increasing its strength and reducing the time during which the castings are treated.

(5) The various methods of control and analysis of materials, control in the course of manufacturing and control of the finished products have been considerably improved in recent years, and the various ways of organizing research work by means of laboratories, technical institutions and technical publications have been greatly developed in the foundry industry.

Interesting Program Arranged for Regional Meeting at Rolla

FINAL plans are being completed for the regional foundry conference arranged under the joint auspices of the Missouri School of Mines and Metallurgy, the American Foundrymen's association, and the St. Louis District Chapter of the A. F. A. which will be held at Rolla, Mo., on Friday and Saturday, Oct. 8 and 9. Advanced interest displayed by foundrymen throughout the Mississippi valley, particularly in the states immediately surrounding Missouri augurs an unusually large attendance. An excellent program has been arranged, and the various subjects to be covered by the speakers is shown in the accompanying tentative program.

Trips Are Planned

A number of "points of interest" trips have been planned in conjunction with the conference. These include the old natural rock blast furnace, the first in that section of the country, and a visit to Ft. Wyman, which was used by the Confederate troops during the Civil war. After the close of the conference on Saturday afternoon, those interested may play golf. Rolla, Mo. is about 120 miles southwest of St. Louis, and is easily accessible either by the Frisco railroad or via highway 66.

Registration will be held Friday morning, Oct. 8 at 9 o'clock. Those in charge of arrangements include Louis Desparois, Pickands-Mather Co., 1010 Pine street, St. Louis, and John W. Kelin, Federated Metals division, American Smelting & Refining Co., 4041 Park avenue, St. Louis. Mr. Kelin also is secretary of the St. Louis chapter. The tentative program is as follows:

Friday, Oct. 8

9:00 a. m. to 10:00 a. m.—Registration (at school)

10:00 a. m. to 12:00 noon—Sands.
Chairman—T. C. Hamlin, U. S. Radiator Corp., Edwardsville, Ill.
"Sand Control Program in the Foundry," by H. W. Dietert, Harry W. Dietert Co., Detroit.
"Sand Reclamation, Sand Conditioning and Sand Control," by L. B. Knight Jr., National Engineering Co., Chicago.
"Sources of Molding Sand for Foundries in Missouri," by Dr. H. A. Buehler, Missouri School of Mines.
"Relation Between Molding Sands and Casting Defects," by C. F. Bunting Southern Malleable Iron Co., East St. Louis, Ill.

10:00 a. m. to 12:00 noon—Refractories
Chairman—George W. Mitsch, American Car & Foundry Co., St. Louis.
"Lining of Reservoirs and Ladles Suitable for Soda-Ash Treatment," by J. J. Offutt, A. P. Green Fire Brick Co., Mexico, Mo.
"Bonds and Grouts," by L. C. Hewitt, Laclede-Christy Clay Products Co., St. Louis.
"Linings for Annealing Ovens and Nonferrous Metal Furnaces," by George D. Cobough, Harbison-Walker Refractories Co., St. Louis.
"Cupola Linings," by James Crawford, Walsh Refractories Co., St. Louis.

12:45 p. m.—Luncheon at Long hotel.
Presiding—G. S. Haley, Century Foundry Co., St. Louis, and chairman, St. Louis district chapter.
Address of Welcome by the director of the Missouri School of Mines.

2:30 p. m. to 4:30 p. m.—Metallography.
Chairman—Charles Y. Clayton, Missouri School of Mines.
"Metallography of Cast Irons," by S. R. B. Cooke, Missouri School of Mines and Metallurgy, S. C. Massari, Association of Manufacturers of Chilled Car Wheels, Chicago, and B. A. Yates, McQuay-Norris Mfg. Co., St. Louis.
"Micro-structure in Cast Iron," by J. J. Picco.

2:30 p. m. to 4:30 p. m.—Nonferrous division.
Chairman—F. T. O'Hare, Central Brass & Aluminum Foundry Co., St. Louis.
"Nonferrous Metals and Alloys," by A. Fritschle, Federated Metals division, American Smelting & Refining Co., St. Louis.
"Insulation, Operation and Maintenance of Nonferrous Metal Furnaces," by P. J. Myall, Fisher Furnace Co., Chicago.
"Use of Plastic Bronzes in Modern Bearing Applications," by Claude C. Morgan, Bronzoid Corp., Dallas Texas.

7:00 p. m.—Dinner at Pierce Pennant dining room.
Presiding—George W. Mitsch.
Speaker—Hyman Bornstein, Deere & Co., Moline, Ill., and president, American Foundrymen's association.
Entertainment—Arranged by C. R. Culling Carondelet Foundry Co., St. Louis.

Saturday, Oct. 9

9:30 a. m. to 11:30 a. m.—Gray Irons and Alloys.
Chairman—Hyman Bornstein, Deere & Co., Moline, Ill.
"Requirements of a Good Base Iron for Alloying," by David B. Reeder, Electro Metallurgical Sales Corp., Chicago.
"Changes in Cupola Technique Required to Meet Special Melting Requirements," by V. A. Crosby, Climax Molybdenum Corp., Detroit.
"Some Practical Applications of Alloys in Gray Iron," by Carl Morken, Carondelet Foundry Co., St. Louis.

9:30 a. m. to 11:30 a. m.—Steel Foundry.
Chairman—Lee Everett, Key Co., East St. Louis, Ill.
"Review of Current Open Hearth Practices," by John W. Porter, American Steel Foundries, Granite City, Ill.
"Electric Furnace in Steel Casting Industry," by L. F. Bartholic, St. Louis Steel Casting Co., St. Louis.
"Some Factors in Alloying of Steel Castings," by T. N. Armstrong, International Nickel Co., New York.
"Importance of Maintenance to Foundry Operations," by Carter Bliss, Scullin Steel Co., St. Louis.

Afternoon—Open to individual wishes. A "points of interest" tour probably will be arranged. The A. P. Green Fire Brick Co. has extended a plant visitation invitation. Other items of interest will be offered.

Book Review

Materials Handbook, by George S. Brady, fabrikoid, 4 x 6¾ inches, 661 pages, published by McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $5, and in Europe by the Penton Publishing Co. Ltd., London.

This is the third edition of this well known volume first published in 1929. Essentially, it is an encyclopedic dictionary of various materials with which the purchasing agent, engineer, executive, and foreman comes in contact. Materials covered begin with abrasives and end with zirconium-ferrosilicon, arranged in alphabetical order. Pertinent facts about each are included so that the reader can obtain a fairly comprehensive idea of the material. While not intended as a metallurgical handbook, information on engineering materials includes data on physical properties, and in some cases, compositions. Many patented and trademarked materials are given, and in the case where the product is limited to one source, the name of the maker is included. An appendix giving units of measure, conversion tables, etc., is incorporated, as is an index.

M. D. Larkin Co., Dayton, O., has been appointed distributor for the General Refractories Co., Philadelphia, in the Dayton area.

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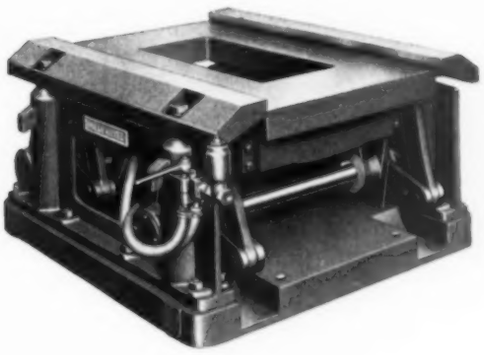

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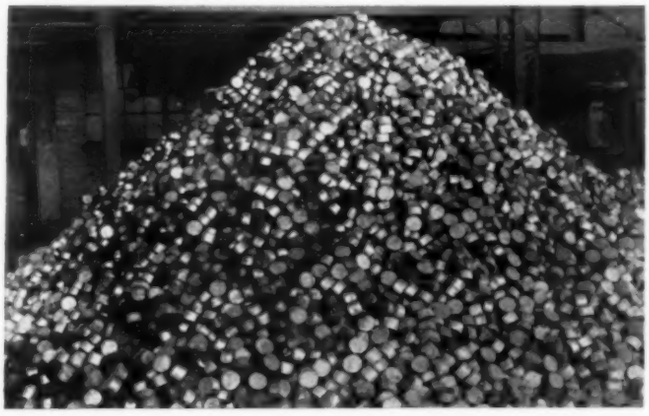

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OBITUARY

FRED DANENFELSER, 39, foundry superintendent, Rock Island, Ill., plant, International Harvester Co., died Aug. 5. He was first employed by International Harvester in 1919 at the company's tractor works in Chicago. In 1927 he went to the Richmond, Ind., plant, returning to Chicago in 1929. Since 1930 he had been located at Rock Island, serving as superintendent for the past five years.

♦ ♦ ♦

John S. Walston, 81, retired superintendent of the Louisville Tin & Stove Co., Louisville, Ky., died Aug. 4.

♦ ♦ ♦

Adelbert G. Clark, for 27 years purchasing agent of the Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y., died Aug. 6 after a brief illness.

♦ ♦ ♦

James V. Watson, 70, former president, United Supply & Mfg. Co., Chicago, died in that city Aug. 5. He retired in 1934 after holding the presidency since 1902. Mr. Watson also had been treasurer, Chicago Car Wheel Co., Griffin Wheel Co. and Ajax Forge Co. of Chicago.

♦ ♦ ♦

James S. Mattimore, 62, vice president of the Walworth Co., New York, manufacturers of pipe fittings and valves, died in Brooklyn, N. Y. Aug. 12. Besides being a director of the Valve and Fittings institute, Mr. Mattimore was treasurer of the Manufacturers' Standardization society.

♦ ♦ ♦

John S. Newberry, 71, member of a pioneer Michigan family and long active in business and industry in the Detroit district, died at his summer home in Watch Hill, R. I., Aug. 23. After completing his college education, Mr. Newberry became assistant manager of the Detroit Steel & Spring Co., later becoming president of the Detroit Steel Casting Co.

♦ ♦ ♦

Albert Wenzel, developer of piston rings for internal combustion motors, died at his home in West Orange, N. J. on Aug. 12. In 1903 Mr. Wenzel organized the American Hammered Piston Ring Co. of Newark, which he sold in 1907, and later became president of the U. S. Hammered Piston Ring Co. of Sterling, N. J. He held patents on piston rings used widely by manufacturers of airplane motors.

♦ ♦ ♦

Edwin C. Washburn, 67, general manager of the Washburn Steel Casting & Coupler Co., Minneapolis, which was founded by his father, died Aug. 10 at his home in Englewood, N. J. He had been assistant to the president of the Baltimore & Ohio railroad since 1911. Mr. Washburn invented several railroad devices, principal among them being the Washburn coupler, an automatic car coupler device.

♦ ♦ ♦

Henry Flockhart, 71, retired foundryman of Newark, N. J., died at his home recently. Mr. Flockhart was born in Scotland and came to this country 50 years ago. He entered the foundry business and for a number of years was superintendent of the Flockhart Foundry, operated by his brother. The plant became the Morrison-Flockhart Foundry in 1921 when he acquired part ownership. Mr. Flockhart retired in 1930.

♦ ♦ ♦

Clifford A. Owens, 54, president of seven industrial concerns producing excavating machinery and tractors, died recently at his home in Marion, O. Mr. Owens was head of the Osgood Co., the Commercial Steel Castings Co., Alloy Cast Steel Co., General Excavator Co., the Hercules Co., Engineering Equipment Co. and Power Mfg. Co. He served on the National Code Authority for Shovel, Dragline and Crane industries during the existence of the NRA.

♦ ♦ ♦

William J. Burkert, 54, secretary-treasurer of the Trenton Brass & Machine Co., Trenton, N. J., died recently at his home after a long illness. Mr. Burkert was connected with the Trenton Brass & Machine Co. for more than 25 years and was identified with local industrial circles, having served as secretary of the membership committee of the Trenton chamber of commerce and as a member of its board of directors.

♦ ♦ ♦

Charles H. Hodges, 77, chairman of the board, Detroit Lubricator Co., Detroit, and one of the organizers of the American Radiator Co., died Aug. 8 in Boston. In 1892, when the Detroit Radiator Co. merged with other companies to form the American Radiator Co., Mr. Hodges became treasurer and member of the executive committee of the new organization, and in 1906 was named vice president. A year later he became president of the Detroit Lubricator Co., and since 1926 had been acting as chairman.

♦ ♦ ♦

Oliver W. Loomis, 65, former vice president of the National Malleable & Steel Castings Co., Cleveland, and a director of that company for the past 13 years, died in Ludington, Mich., Aug. 19, while vacationing with his son. Mr. Loomis joined the National Malleable & Steel Castings Co. in 1891 and served in various capacities until 1919 when he was appointed sales manager. Five years later he became a director and the next year was made vice president. He was first vice president from 1933 until his retirement in 1936.

♦ ♦ ♦

Ralph A. Young, 62, chief metallurgist, Marion Steam Shovel Co., Marion, O., died July 31 at his home in Marion. Mr. Young attended Heidelberg college and Ohio State university, graduating from the latter institution in 1899 and later taking post graduate work there. He joined the Marion Steam Shovel Co. in January, 1904, after having been associated for several years previously with the Buckeye Steel Casting Co., and prior to that with the Columbus Iron & Steel Co., both of Columbus, O. During his 33½ years of service with the Marion company, he installed a chemical laboratory for that concern. Mr. Young, besides being an authorized professional engineer in metallurgy, was a member of the American Institute of Mining and Metallurgical Engineers and the American Society for Metals.

Iron Pavement

CAST iron paving is to receive a good test in Detroit. Originally it was proposed to lay blocks made by the Interlake Iron Corp. at its Toledo Furnace Co. division on Shelby street, between Woodbridge street and West Jefferson avenue. But Commissioner L. G. Lenhardt, of the department of public works, considered this area unsatisfactory for a conclusive test because of the light traffic. So, streets in the vicinity of the eastern market, where there is plenty of traffic, will be used.

Covers Molybdenum In Gray Iron

Climax-Molybdenum Co., 500 Fifth avenue, New York, has published the first four sections of an interesting and valuable book entitled "Molybdenum in Cast Iron." The first three sections cover the metallurgy and production of molybdenum irons.

Section 1 deals with a general discussion of the subject. The second section is devoted to alloy irons, the third to alloy combinations, and the fourth to applications of gray iron alloyed with molybdenum. Other sections on malleable and white iron will be presented later.

The sections are presented in loose leaf form so that others may be added as they are available.

ADVERTISING PAGES REMOVED

Fig. 5—Looking along the molding line showing machines on left and conveyor on the right

Fig. 7—All castings turned out in the foundry are subjected to a press-straightening operation

Maintains Close Control

(*Continued from page 26*)

diameter stem, and which ordinarily tend to burn on the stem before the body is baked. The oven occupies a floor space 12 x 15 feet, and is 73 feet in overall height of which 11 feet is below the floor level. Cores are carried on shelves 36 inches wide and 8 feet 4 inches long. The shelves spaced 24 inches apart are mounted two to a carrier. The carriers on 66-inch centers are supported by continuous chains on each side which ride on two 120-inch pitch diameter sprockets in the head shaft.

The total number of carriers is 26, and each shelf will accommodate 32 differential housing cores. Cycle is divided in the oven into a 3-hour bake and a 1-hour cool. A baffle divides the oven into two separate sections to accommodate those periods. In addition to the baffle, a proper static balance is maintained in the oven to insure that no cooling air is drawn into the baking section. A diagrammatic sketch of the oven is shown in Fig. 6.

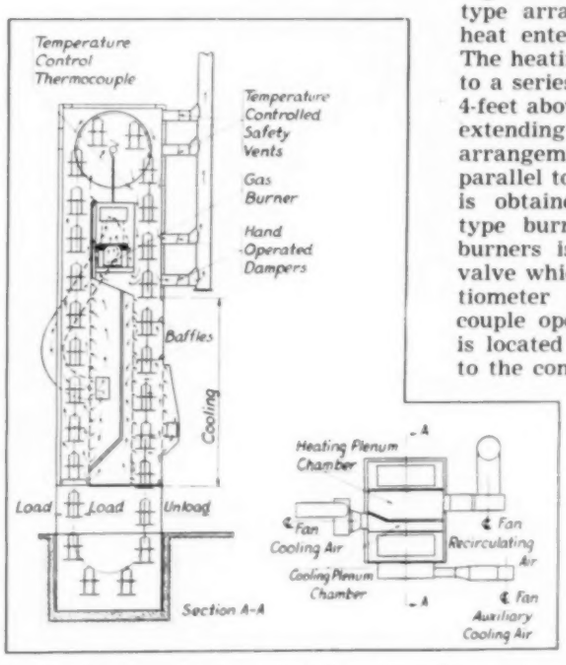

Fig. 6—Schematic sketch indicating travel of various heating and cooling currents

No Radiant Heat Enters

The oven heater, gas-fired and of the recirculating type, is located approximately at the top of the cooling section, and is a semi-external type arranged so that no radiant heat enters directly into the oven. The heating gases are carried down to a series of ports beginning about 4-feet above the loading station, and extending up about 30 feet. By that arrangement, the gases travel parallel to the core movement. Heat is obtained from two inspirating type burners, and control of the burners is through a full floating valve which is actuated by a potentiometer controller. The thermocouple operating the potentiometer is located slightly above the intake to the combustion chamber.

As a further protection to insure that the hot gases entering the oven are never higher than desired for proper operations, a thermocouple is located in the delivery duct. That couple actuates a potentiometer controller which in turn operates a safety, gas turndown valve. Temperature of the oven is maintained at 400 degrees Fahr. within plus or minus 2½ degrees. Cooling occupies 1 hour, and the section of the oven devoted to that phase is cooled by drawing air up through the downtake shaft by an exhaust fan which discharges into the atmosphere.

A series of baffles forces the cooling air to travel around the cores, and in addition the cooling air can be passed across the trays during the last 20 feet of travel. The latter is used only in summer or during heavy loading when additional cooling is required. Chain travel is intermittent, and is controlled by a limit switch actuated by the trays and a repeating electrical timer which can be adjusted for any cycle that is desired.

Intermittent chain travel permits the core shelves or trays to be stationary and level during the loading period. The trays are quiescent for a period of 5 minutes and 45 seconds during the present 4-hour cycle, and 15 seconds is required for one shelf to move up and another to locate in position for loading. A heating and cooling curve taken in the oven is shown in Fig. 8.

As may be observed from Fig. 1, cores are made on 4 rollover core

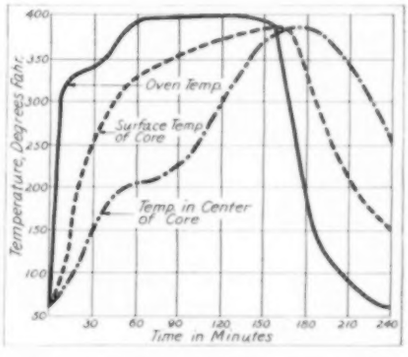

Fig. 8—Time-temperature curve showing conditions in oven and cores

machines located at the corners of the uptake shaft. Two machines are in the front and two in the back so that the trays are loaded on each side. Travel of the chain is arranged so that the trays are in the best loading position. Each core maker fills one-quarter of a tray and produces approximately 80 cores per hour. Cores unloaded at the back on the downtake side, are inspected and sent directly to the foundry. Driers are left on the trays and carried around to the coremakers. Production of baked cores averages about 320 per hour.

Technical Foundry Conference To Be Held at Columbus

SPONSORED by the American Foundrymen's association in co-operation with Battelle Memorial institute, a conference devoted entirely to technical subjects will be held at the institute laboratories, Columbus, O., September 30 and October 1. While differing in some measure from previous joint conferences of the association arranged with technical schools, local chapters of its own and other engineering and educational societies, the program, which is nearing completion, will be directed along foundry metallurgical lines. Metallurgists and educators versed in the technical phases of foundry production will deliver papers under the three main headings of steel, nonferrous and gray cast iron. Attendance and participation of the foremost authorities gives opportunity for a practical short course in these subjects to all interested.

Meetings of various A. F. A. committees are being scheduled for Thursday morning, and the formal program will be held Thursday afternoon and Friday. As an added attraction to those contemplating attendance at the conference, tickets may be reserved for the Ohio State-Purdue game to be held in the Ohio State university stadium Saturday, October 2.

A dinner with short addresses will be held Friday evening at one of the downtown hotels, the noon luncheon that day being staged at the institute. A special inspection tour of the numerous research laboratories of the institute will be made Saturday morning. Dr. C. H. Lorig and C. E. Sims of the institute are in charge of the general local arrangements for the conference.

For those remaining Saturday afternoon, tickets should be reserved as soon as possible through Dr. C. H. Lorig, Battelle Memorial institute, Columbus, Ohio. While Columbus has many hotels, those planning to attend are urged to make reservations as soon as possible. Hotels include the Deschler-Wallick, The Neil House, Seneca, Virginia, Fort Hayes and the Chittenden.

The tentative program is as follows:

Section A—Steel Castings.
Presiding, E. W. Campion, Bonney Floyd Co., Columbus, Ohio.
(1) Effects of Alloys on Cast Steels. Discussion leader—Walter Crafts, Union Carbide & Carbon Co., Niagara Falls, N. Y.
(2) Effects of Aluminum on Physical Properties of Steel Castings. Discussion leader—C. E. Sims, Battelle Memorial institute, Columbus, Ohio.

Section B—Nonferrous Castings.
Presiding, Dr. H W. Gillett, Battelle Memorial institute, Columbus.
(1) Effects of Chromium in Copper Base Alloys. Discussion leader—Dr. Bruce Gonzer, Battelle Memorial institute, Columbus, Ohio.
(2) Melting methods in the Nonferrous Casting Industry. Discussion leader—Harry M. St. John, Detroit Lubricator Co., Detroit, Mich.

Section C—Relation of Structure to Properties of Cast Iron.
(1) Cupola Cast Irons. Discussion leader—John W. Bolton, Lunkenheimer Co., Cincinnati, Ohio.
(2) Electric Furnace Irons. Discussion leader—Richard Schneidewind, University of Michigan, Ann Arbor, Mich.
(5) Fundamental Structures of Gray Cast Iron. Discussion leader—Alfred Bovles, Battelle Memorial institute, Columbus, Ohio.

Publishes Bulletin

American Foundrymen's association, Chicago has published in pamphlet form, papers and discussions presented at the Milwaukee convention on good housekeeping and safety in foundries, and industrial codes and occupational disease legislation. The bulletin, which contains 61 pages, includes seven papers and two transcripts of sessions proceedings. Copies of the bulletin may be obtained from the association for $1.50. Price to members is 75 cents.

Book Review

A. S. T. M. Methods of Chemical Analyses of Metals, 250 pages, published by the American Society for Testing Materials, 260 South Broad street, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $2.50 in cloth binding, $2.00 in heavy paper cover, and in Europe by the Penton Publishing Co. Ltd., London.

For the first time the A. S. T. M. has issued a publication giving under one cover all of its methods of chemical analyses of the ferrous and nonferrous metals. These include four methods of analyzing ferrous metals, 12 for nonferrous metals and alloys and three methods of quantitative spectrochemical analysis of nonferrous metals. Included in the volume are the amplified and modernized methods of chemical analysis of steel, cast iron, open-hearth iron and wrought iron. These new methods provide an up-to-date treatise on the determination of important elements.

Methods for sampling and analysis of several ferroalloys are included. The section on nonferrous metals embraces methods for the analysis of bearing metals, brass and bronze, aluminum alloys, pig lead, slab zinc, nickel, electrical-resistance alloys and silver solders.

Arrange Conference For Iowa

Preparations are under way for the second annual Iowa conference to be held at Iowa City, Oct. 29 and 30. The conference is sponsored jointly by the Quad-City Chapter of the American Foundrymen's association, and the engineering college, State University of Iowa, with the co-operation of the Northern Iowa Foundrymen's association. Details of the tentative program will be announced later, but present plans include talks and discussions on sand control, testing and analysis of cast iron, cupola practice, alloy cast iron and nonferrous metals.

The Quad-City chapter committee, co-operating with the university staff in developing the program, includes: Chairman, T. J. Frank, Frank Foundries Inc., Davenport, Iowa, and Horace Deane and E. A. Gullberg, Deere & Co., Moline, Ill.

Creep Information

The British Nonferrous Metals Research association, London, England, has published a 19 page bulletin, entitled, "Creep of Nonferrous Metals and Alloys," by W. A. Baker, which reviews the published information on that subject. Data presented have been selected critically, and include information on copper and copper alloys, nickel alloys, aluminum and aluminum alloys, and lead. The numerical values are arranged in tabular form with compositions of materials, and a bibliography of literature on which the data are based. The bulletin also includes an index.

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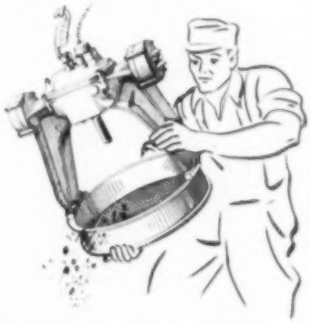

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Brass Shop Practice

(*Continued from page 27*)

just over the surface of the mold as the metal covers it. This tends to retard the burning effect of the hot metal on the sand itself.

Moisture content in molding sand should be maintained at a definite standard to minimize blows from vaporization of the moisture. The American Foundrymen's association bulletin, *Testing and Grading Foundry Sands*, 1931, gives a complete outline of the methods of testing for determination of moisture content in molding sand, and recommendation on desired percentage of moisture and preferred venting capacity, or as it is generally known — permeability. Data published in several bulletins by the American Foundrymen's association relative to molding sand are valuable and should be in the hands of every foundryman. If the moisture content is maintained accurately at the desired point, one definitely can assure himself that his troubles are not caused by blows from the sand in one instance, if they are not caused by that same reason in another instance where the same castings are poured in similar molds from the same or similar pots of metal. Therefore, the cause for defectives may be looked for elsewhere.

Provide Proper Prints

Prints for large cores should be well provided with substantial support to prevent any sagging of the print and consequent throwing the core out of position. The bottom board should be straight and of adequate strength to support the mold properly and prevent the sand from sagging under the weight of metal. Many a mold has produced defective castings through this cause.

In some classes of castings, a facing sand is desirable to reproduce fine ornamentation or extra fine finish. A clean cut finish is desirable on ornamental castings or those with lettering on the face. Facing sands are made from a variety of mixtures. The best facing sands are those containing a minimum amount of combustible material and a minimum amount of moisture or other material that will turn into gas when heated. A good grade of fine silica sand, fineness governed by the surface desired, mixed with a small amount of a wash made up of fire clay and water of a thin, creamy consistency, makes a very satisfactory facing sand. The amount of wash carefully is worked into the sand and thoroughly mixed. The amount of wash is the least possible amount that will bond the grade of sand sufficiently to withstand the effect of metal washing over the mold.

Other mixtures are made up of sand and molasses water, or sand and core oils similar to core sand mixtures. Sand in the facing mixture is much finer than that in cores and sometimes contains some molding sand. The molding sand should be as free as possible of any vegetable or animal matter liable to form gas when heated. In using such facing sand, a small quantity carefully is sifted over the face of the pattern and then backed up with molding sand from the heap and the molds rammed as usual. After the pattern is drawn the mold is subjected to some drying effect, preferably oven drying. If this is not available, a good skin drying may serve if the mold is poured immediately after skin drying is completed and before the sand has a chance to reabsorb moisture from the surrounding atmosphere. It is desirable in skin drying practice to dry slowly and evenly. Rapid drying might cause the facing to crack and thus defeat the desired end of a high finish and ornamental surface on the castings.

It is desirable to have ornamental surfaces in the drag side of the mold. If small gas bubbles should form, they will rise away from this ornamental surface to leave that surface clean and of good appearance. Where ornamental surfaces are cast in light metals, aluminum or magnesium, sometimes it is preferable to have the ornamental face up or in the cope side of the mold. It is advisable to have the mold in a sloping position so that the metal rises gradually along this ornamental face and carries any gas bubbles ahead of it as the metal rises in the mold, thus producing a finer finish than where the face is down and consequently tends to burn into the sand.

Usually for nonferrous castings, molds are rammed softer than they are for ferrous metals. Molds for the lighter metals, aluminum and magnesium, should be rammed even softer than for brass and bronze. There are two reasons for this, first, venting is better if the mold is rammed soft, and second, these metals are hot short. Any resistance on the part of the mold to their shrinkage may cause cracks to develop in the casting. Cracks may not be seen but they result in defective castings whether they are seen or not.

Chaplets are not used any more than necessary in nonferrous molding practice. The temperature at which these metals are poured does not melt the chaplets into perfect bond every time. Oxides formed on many nonferrous metals prevent the proper knitting of the chaplets with the inflowing metal. Therefore, it is better practice to find some other means to support the cores. Of course, there are occasions when chaplets must be used. They must be considered carefully with regard to thickness and general design. Provision must be made to supply ample amount of metal to properly bond them into the wall of the casting. Frequently, a change in pattern design will obviate the use of chaplets. In many instances engineers who have designed the casting will be glad to make slight changes to insure sound castings.

Mold Position Important

After a good mold has been made and all the necessary precautions taken for proper entrance of the metal in a quiet, clean stream, the question of how the mold should stand on the floor also should be considered to insure quiet entrance and steady flow of metal rather than a sporadic spreading of the metal over the surface of the mold, with consequent need for reuniting the different streams as they again come together. Some molds should be cast on edge, some on the slope, to insure the steady upward flow of the metal.

Size of the sprue through which metal enters the mold should be established most carefully to insure sufficient amount of metal for filling the mold at the desired speed; but small enough to insure being kept full throughout the time of the entire pouring period so that no dross or air may be sucked down with the entering metal. This is important in the molding of nonferrous castings and too often neglected. Frequently it is the cause of surface and other types of defects that are blamed on other causes. Frequently, it is the cause of bubbles usually blamed on hard ramming or hard cores. The sprue entrance should be well reamed out so that pouring is simplified. There should be no break in the stream after it has started in its downward flow into the mold. A steady flow of metal should be maintained until the mold is filled completely.

Many types of skim gates are recommended by their sponsors. They may have merits in some instances, but certainly in the writer's opinion their greatest merit is that they govern the flow of metal from the sprue to the mold. The metal is poured at a standard speed and the sprue is kept full all the time the

(*Continued on page 75*)

MISSING PAGES REMOVED

(*Concluded from page 72*)
metal is passing through. Any good method which will establish the proper rate of pouring and enable the man pouring the mold to maintain that rate for each and every mold poured and at the same time keep the sprue full so that no air or dross is sucked into the mold, will reduce the defective loss materially and improve the appearance and quality of the castings. Some nonferrous castings need to be poured slowly as in the case with some of the other alloys. Any sprue system or method designed to govern the rate of flow must change to conform with the proper practice for the alloy to be poured. Yellow brass must be poured strongly and the mold must be filled rapidly. A gating system must be provided to permit this and the sprues must be designed with that end in mind. Red brasses need not be poured as strongly. Aluminum bronze and manganese bronze should be poured quietly and steadily, rather than forcefully and with great speed.

Given good metal, properly melted, a good mold with good cores and the gates properly designed, the production of nonferrous castings becomes a simple matter and something that can be repeated over and over with little or no variation in the quality of the product. However, the gating must be designed to insure uniform results for any given alloy. Gating, a large and important subject, will be considered in a later discussion.

Conveyors Speed Foundry Work

PUTTING *flow* into production is the goal of every manufacturing plant. Stated briefly, that means the co-ordination of all manufacturing into one smoothly functioning unit from start to finish without waste of time, effort or space. Modern conveying methods are the basis for this new trend and makes it both practical and highly desirable.

The accompanying illustrations supplied through the courtesy of the Logan Co., Louisville, Ky., are from a foundry making electric motor castings and afford an excellent example of effectively applied *flow*, or straight-line production.

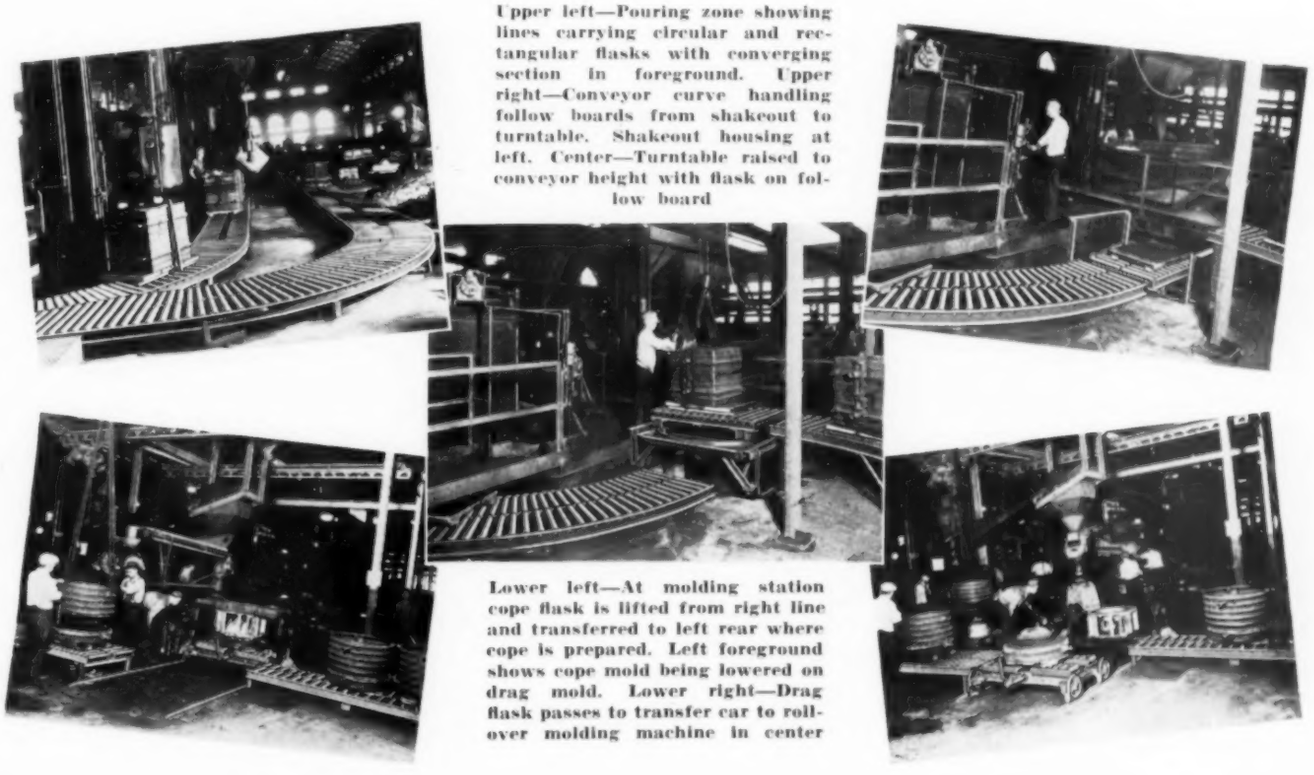
Ball-bearing roller conveyor is employed with interesting variations in the form of transfer cars, *Y*-section, and air-cylinder-operated unit for elevating and lowering.

Sequence of operations in the foundry from which the illustrations are taken is as follows: Cope and drag molds are made up in two molding zones. The heavier castings are made up on an outer conveyor line shown at the upper left and the lighter ones in smaller flasks on the inner line. For the heavier molds a transfer car, shown at the lower right, receives the completed drag on follow-board from a roll-over-draw machine. The car, when moved over, transfers the mold onto the extreme left conveyor line.

From the molding stations shown at the lower left and right the two roller conveyor lines lead to the pouring zone depicted at the upper left where pouring ladles are suspended from overhead cranes. Beyond the pouring zones as indicated at the upper left they converge into a single line just ahead of the shakeout. The converging section is provided with a foot-operated brake to avoid possibility of flasks jamming.

At the shakeout, which is enclosed in a ventilated housing, as shown at the center and upper right, the mold is pushed off at right angles by an air cylinder and through air-operated doors onto a bumping grate. The follow-board remains on the conveyor and travels by gravity to the roller turntable. Turntable and follow-board are then raised by air cylinder to the same elevation as the empty flask return conveyor.

After the sand has been shaken out of the flask, the sand is carried away on troughed belt for reprocessing and the casting is lowered to an



Upper left—Pouring zone showing lines carrying circular and rectangular flasks with converging section in foreground. Upper right—Conveyor curve handling follow boards from shakeout to turntable. Shakeout housing at left. Center—Turntable raised to conveyor height with flask on follow board

Lower left—At molding station cope flask is lifted from right line and transferred to left rear where cope is prepared. Left foreground shows cope mold being lowered on drag mold. Lower right—Drag flask passes to transfer car to roll-over molding machine in center

apron conveyor (beneath the floor) which carries it, as it cools, to the cleaning room. The empty flask is picked up by an overhead hoist and deposited on the follow-board already arrived on turntable. The turntable then is revolved to line up with the empty flask conveyor line, and flask returned to molding zone or storage.

Flasks are pushed manually throughout. In the pouring areas the lines are level. Elsewhere they have a slight grade to make the pushing easier. Heavy loads are easily set into motion on ball-bearing rolls.

Book Review

A. S. T. M. Tentative Standards, 1936, 1390 pages, published by the American Society for Testing Materials, 260 South Broad street, Philadelphia, available to other than members of the society at $7.00 in paper binding or $8.00 in cloth, plus 15 cents postage, through THE FOUNDRY, Cleveland, and in Europe through Penton Publishing Co. Ltd., London.

This book contains 264 tentative specifications, methods of testing, definitions of terms and recommended practices covering materials of engineering and the allied testing field. Of these, 47 relate to ferrous metals, 33 to nonferrous metals, 35 apply to cementitious, ceramic, concrete and masonry materials, 140 cover miscellaneous materials such as paints, petroleum, insulation, textiles, etc., while 9 are general testing methods applying to these materials.

The term tentative applies to a proposed standard published for 1 or more years with the view of eliciting criticism before it is formally adopted as standard by the society. Tentative standards represent the latest thought of the committees on the subjects covered. This volume is of particular value since full opportunity is provided during the period of promulgation, for consideration by all interested parties through publication as tentative before adoption as standard.

Lathe Operation

South Bend Lathe Works, 435 East Madison street, South Bend, Ind., has published the 33rd edition of "How To Run a Lathe." The book is intended primarily to assist the mechanic and machinist in the care and operation of back geared screw cutting precision lathes. The fundamental operations of modern lathe practice are well illustrated and described.

The book may be obtained from the company for 25 cents.

To Discuss Impact Testing Phases

The first technical meeting under the auspices of the Joint Committee on Materials and Their Testing, a recently formed organization in England, will be held at the College of Technology, Manchester, on Friday, Oct. 29. Papers on notched bar impact testing to be presented at the meeting include the following:

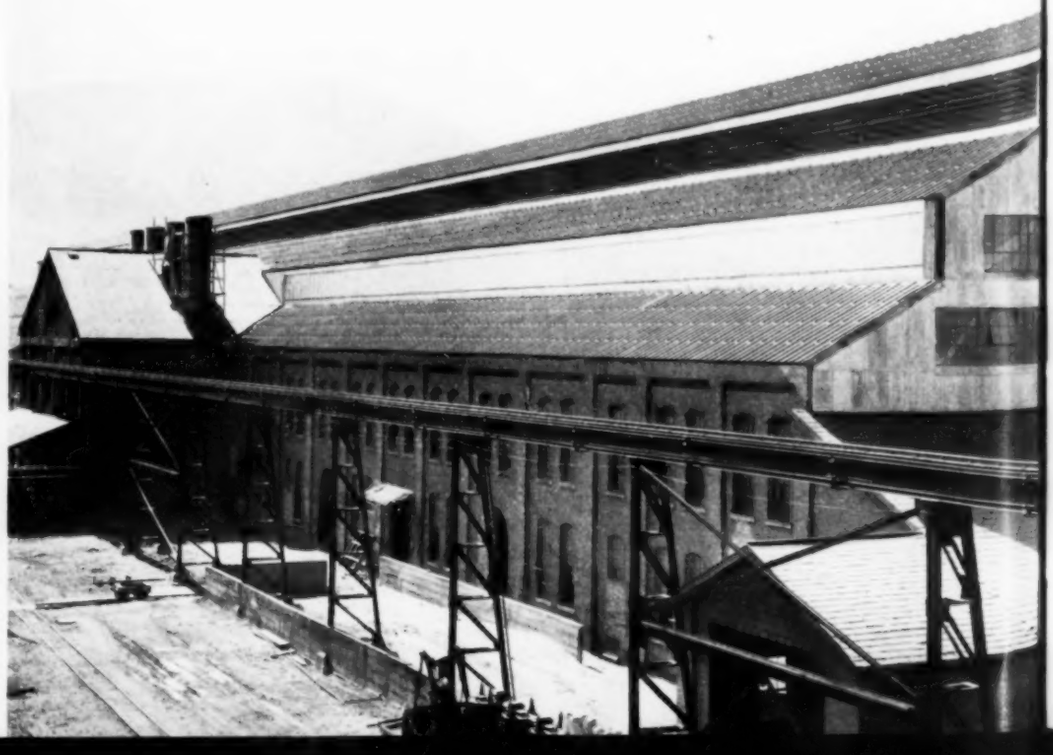
"The Physical Meaning of Impact Tests," by Prof. R. V. Southwell, University of Oxford; "Some Aspects of the Notched Bar Test," by L. W. Schuster, British Engine Boiler & Electrical Insurance Co., Manchester; and "The Development and Present Position of Continental Research on the Notched Bar Impact Test," by Dr. Ing. Max Moser, Friedrich Krupp, Essen, Germany.

Postpones Outing

Annual outing and golf tournament of the Chicago chapter, American Foundrymen's Association, has been postponed until Oct. 2. The party will be held at the Lincolnshire country club, Crete, Ill. The committee in charge is headed by J. H. Abbott, Hickman, Williams & Co., and W. C. Packard, National Engineering Co.

Roof Covered With Cast Iron Plates

THE ROOF on this foundry, the Chattanooga, Tenn., plant of the United States Pipe & Foundry Co., presenting 85,600 square feet of surface, is covered with cast iron plates. This type of roof covering designed and manufactured by the company, is securely locked to the frame work and yet free to expand and contract through temperature variations. Individual plates 24 x 52 inches are laid on a purlin spacing of 4 feet. The plates are flanged along the edges and have a hood down the center. They are laid about 1-inch apart along the purlins. Cast lugs hold them on the slope. Joints are covered by semicircular cap plates locked to the purlins by cadmium plated fasteners. The entire installation includes over 10,000 plates and an equal number of cap plates. The roof made up of these 3/16-inch thick plates weighs only 10.8 pounds per square foot. It is claimed that the roof is 12 times as strong as the minimum specified in one of the codes under which the roof is approved. Tests taken at Columbia University, New York, indicate this roof will support a load of 500 pounds per square foot on 4-foot centers.



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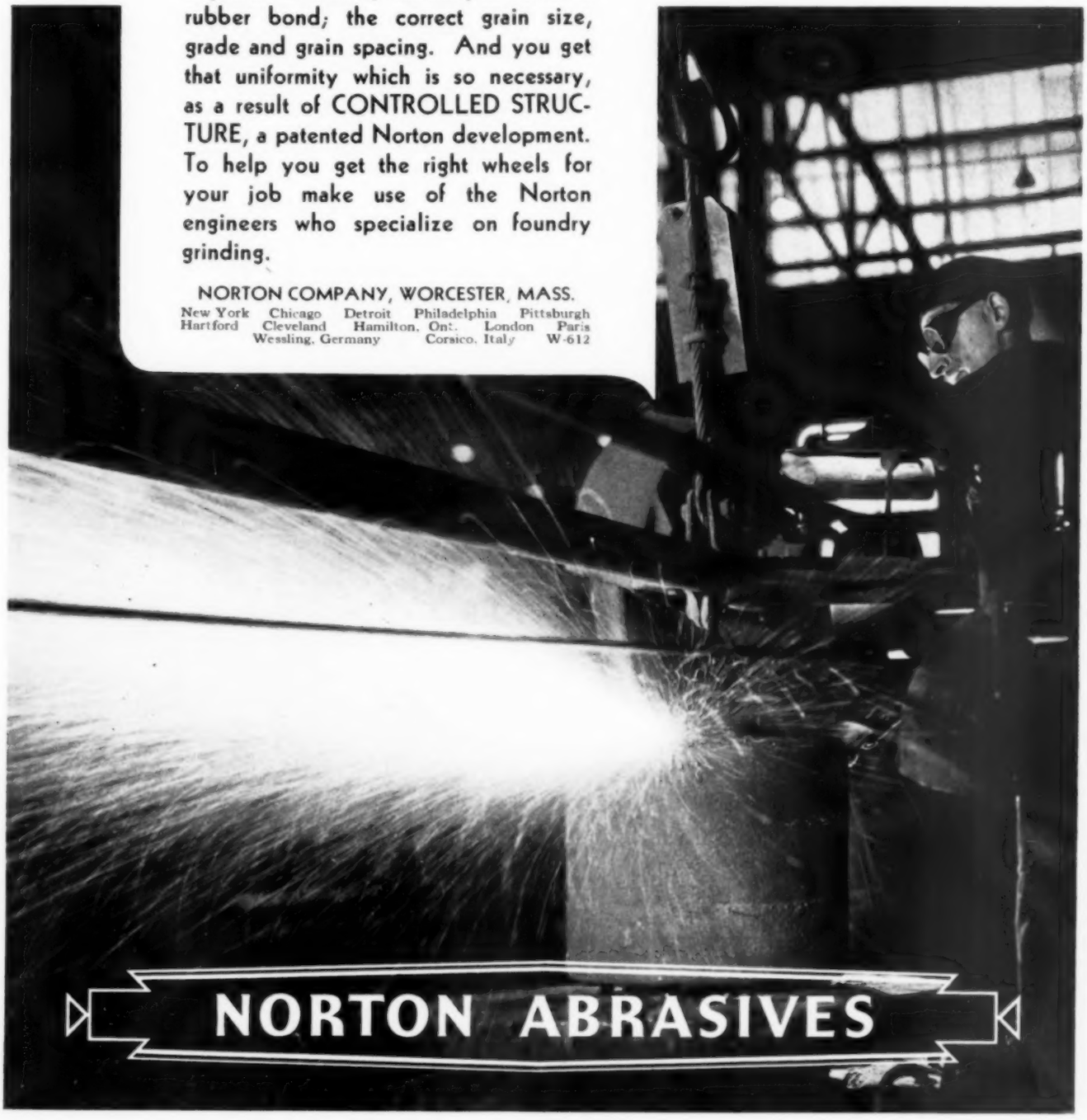

NORTON ABRASIVES

Making Good Cores

(*Continued from page* 30)

binder for cores is some form of core oil. In its simplest form, core oil is a raw linseed or similar drying oil which depends on the strength developed on baking in the presence of free oxygen. The oil in its original form is an unsaturated hydrocarbon with one or more unsaturated bonds to which the oxygen furnished is attached in baking. This results in an oxidized, fully saturated and staple material of high strength. All of the simple core oils listed in Table III are free flowing and give relatively low green strength.

Drying rate of these oils is inversely proportional to the iodine number and the strength developed is roughly proportional to that value. Reference to the table will show, therefore, that of these oils linseed gives the highest strength and most rapid drying.

Oil Strength Varies

The baking properties of these oils vary with the iodine value. Linseed oil in a 1-inch cross section core shows its best strength on baking at between 400 and 425 degrees Fahr. and reaches its maximum strength at from ¾ to 1 hour and retains that strength on holding at those temperatures for 1 to 1½ hours. Soya bean oil on a similar core requires from 1½ to 2 hours to develop its maximum strength at a temperature up to 450 degrees Fahr., but retains its maximum strength at this temperature only for one-half the time that linseed oil would. Perilla oil bakes as rapidly and at slightly lower temperature than linseed, but its strength drops abruptly if held at the baking temperature for any length of time. Recovered linseed requires slightly higher temperature than pure linseed for baking and its strength retention is about twice as critical as linseed.

Table II

Progressive Subdivision of a Cube

1 unit mass = 1 cm. cube

Length Side	Number of cubes	Total Surface
1 cm. = 0.3937 inches	1	.93 in.²
1 mm. = 0.0394 inches	1,000	9.3 in.²
0.1 mm.	1,000,000	93 in.²
0.01 mm.	1,000,000,000	930 in.²
0.001 mm. = 1 micron	1,000,000,000,000	212 ft.²
0.1 micron	1,000,000,000,000,000	2,118 ft.²
0.01 micron	1,000,000,000,000,000,000	21,274 ft.²

Core Oil Composition

Perhaps in no field of the foundry materials has there been more development and progress in recent years than in the evolution of core oils. Since the proportion of oil is dependent on the surface it is capable of covering, it was early found that dilution of the drying oils with kerosine allowed better oil ratios to be obtained; and, to prevent draining of the oil to the bottom of the core due to this thinner, rosin was added to increase the viscosity of the oil. Practically all commercial core oils today are mixtures of the base drying oil with varying proportions of thinner and rosin.

In recent years a number of further developments in oil have been placed on the market for specific purposes. Among these are emulsified core oils in which a water suspension of the drying oil and some thinner such as acacia or rosin is used. These oils are said to give a maximum of green strength with a minimum of residue of bonding material and gas. Recently rubber, in form of either rubber latex or solutions of rubber has been experimented with, with some success.

Bakelite type resin core binders are being used to a limited extent in special applications; and substitutes for natural drying oils are in common use, made of polymerized by-products of the petroleum industry. Further, drying oils such as linseed are being used boiled, and in the presence of metallic oxides to accelerate their drying rates with success; their properties differing from the original material.

Use Cereal with Oil

The characteristic common to all straight sand and oil mixtures is a low green strength due to the lubricating action of the oil on the sand particles; allowing a core assembly to sag. Strength of such mixtures ranges from one-tenth to less than one-half pound green compression. The green strength can be materially increased by the admixture of fine sand to the base sand used. That is the function of such sands as Providence and bank sands.

Cereals are used in modern core mixtures to lend increased green strength and to increase the rate of core disintegration. For some types of work it is possible to obtain a lower core material cost using mixtures of cereal and oil than with straight oil. It is possible to make cores entirely of cereal but such cores have a high rate of water ab-

(*Concluded on page* 81)

Table I

Characteristics of Various Sands for Cores

Designation	Illinois	Missouri	Pennsylvania	Lake Sand	Bank	Jersey
Screen Analysis						
On 6	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00
20	0.22	0.00	2.23	0.00	tr.	0.00
30	1.16	0.32	9.23	0.10	0.20	9.50
40	27.66	8.26	27.21	1.30	0.80	4.65
50	42.40	34.10	29.79	16.20	2.00	29.55
70	16.48	37.20	16.10	54.40	6.30	50.50
100	7.30	14.24	10.28	24.60	23.70	10.10
140	2.34	3.58	3.10	1.60	40.80	2.50
200	1.04	0.76	1.10	0.40	21.60	tr.
270	0.28	0.44	0.22	0.20	3.20	0.00
Pan	0.10	0.26		0.02	0.80	0.00
Clay	0.84	0.84	tr.	0.32	0.27	tr.
Av. Grain Size	44	52	30.5	54.5	101.2	49.3
Origin	St. Peters Deposit	Gulf	Crushed Rock	Glacial Lake	Lake Bottom	Tidal Deposit
Grain Structure	Solid	Solid				
Shape	Rounded	Rounded	Angular	Sub-Angular	Sub-Angular	Sub-Angular

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Table III

Physical Properties of Core Oils

Oil	Linseed	Fish Oil Menhadden	Poppy Seed	Soya Bean	Perilla	Recovered Linseed
Class	Drying	Semi-drying	Semi-drying	Semi-drying	Semi-drying	Drying
Sp. Gr.	0.923-0.928	0.923-0.933	0.924-0.926	0.924-0.927	0.925	0.932
Iodine	175- 202	148- 185	128- 141	122- 134	163- 165	150
Sap, pounds	188- 195	189- 193	193- 195	189- 194	189- 195	193
Acid, pounds	1-3.5	5-8	2.5	0.3-1.8	2	109-110
Unsap.	0.4-1.2	0.6-1.4	0.43	1.3-1.5	5-10	.....

(*Concluded from page* 78)

sorption from the atmosphere and mold, and therefore lose their strength rapidly on standing. The cereals most commonly used are dextrine, cornstarch, flour sweepings, molasses, and in this water soluble group may be placed glutrine which is a by-product of paper pulp manufacture. Table IV gives a number of typical mixtures with straight oil and various sands and with combinations of cereal typical of modern practice.

In some branches of the industry, particularly in dry sand work, on large castings exceedingly high strengths are necessary to resist thermal effects of the metal, and pitch frequenly is used as a core binder. This always is used in connection with an auxiliary clay binder; the clay giving the actual strength and refractoriness and the pitch compensating for the contraction of the clay on pouring. Such cores are exceedingly rigid and have a tendency to be difficult to remove; and, in metal having high shrinkage, cause internal strains and cracks in the casting. The practice in making such cores is to relieve the center of such core with large coke or similar material to minimize stresses and serve as a venting passage for the low permeability sand thus made.

Southern California Chapter Meets

Approximately 63 foundrymen and guests attended the meeting of the Southern California Chapter of the American Foundrymen's association, held July 22 at the Clark hotel, Los Angeles. Robert Gregg, Reliance Regulator Co., Alhambra, Calif., and chairman of the chapter, presided. E. F. Green, Axelson Mfg. Co., chairman of the membership committee reported that the chapter now has 72 members. Just previous to the regular meeting, the directors met and appointed D. C. Murray, H. C. Donaldson Co., to act as treasurer.

The following directors were elected to serve for two years: J. H. Wilkins, Vernon Foundry Co.; G. W. Merrefield, Kay-Brunner Steel Products Co.; E. F. Green, Axelson Mfg. Co.; and Earl Anderson, Enterprise Foundry Co. Those serving for one year are: James E. Eppley, Kinney Iron Works; Albert G. Zima, International Nickel Co.; W. C. Patterson, General Electric Co.; and C. E. Hopping, Alhambra Foundry Co.

Committee chairmen appointed were: Charles Gregg, Reliance Regulator Corp., house and reception; Earl Anderson, Enterprise Foundry Co., finance; M. S. Robb, Bethlehem Steel Co., publicity; Albert G. Zima, International Nickel Co., program; E. F. Green, Axelson Mfg. Co., membership; S. R. Kimberly, Los Angeles Steel Casting Co., education; J. H. Wilkins, Vernon Foundry Co., apprentice training; W. A. Ashman, Balfour-Guthrie Co., A. M. Barker, Independent Foundry & Supply Co., and J. E. Hyatt, Grant & Co., entertainment.

M. T. Davis, General Electric Co., Ontario, Calif. spoke on "High Strength Cast Iron" and gave an interesting and comprehensive presentation of the history of cast iron, particularly the developments and improvements of that material during the past 25 years.

Table IV

Actual Typical Core Sand Mixtures

Type	1	2	3	4	5	6
Use	Radiator	Fine Castings	Core Blower	Pipe Fittings	Malleable	Chunky Cores
Screen Analysis						
On 20	0.0	tr.	0.13	0.1	0.13	2.28
30	1.3	0.2	1.13	1.3	1.13	8.26
40	3.7	0.8	11.47	16.2	11.47	21.77
50	23.1	2.5	38.37	54.4	38.37	36.00
70	43.0	18.0	24.30	24.6	24.30	24.18
100	15.3	43.4	14.67	1.6	14.67	5.37
140	2.4	30.5	7.46	0.4	7.46	0.04
200	0.4	4.4	1.20	0.2	1.20	0.75
270	0.1	0.5	0.26	0.3	0.26	0.16
Pan	tr.	111	71	54.5	71	52
Average Grain	47					
Structure	Rounded	Rounded	Rounded	Rounded	Rounded	Rounded & Angular
Moisture, Per Cent	4.85	5.45	2.30	5.10	5.11	5.24
Sand-Oil Ratio	55:1	40:1	38:1	62:1	200:1	72:1
Sand-Cereal Ratio	0	0	0	86:1	27:1	60:1
Permeability	272	68	78	90	133	198
Green Compression Pounds per Square Inch	0.23	0.37	0.42	0.48	0.67	0.73
Transverse Strength Pounds per Square Inch	42.0	48.5	72.4	37.0	30.0	46.5
Residual Carbonaceous Matter, Per Cent	0.63	0.83	0.94	0.99	0.43	1.39

No 1 Mix—Coarse rounded grain sand and straight oil binder.
No. 2 Mix—Fine rounded grain sand and straight oil binder.
No. 3 Mix—Mixture coarse and fine grain sand and straight oil binder.
No. 4 Mix—Coarse rounded grain sand and cereal and oil binder.
No. 5 Mix—Same as (3) with cereal and oil binder. No. 6 Mix—Mixture of coarse rounded and angular grain with cereal and oil binder.

Arrange Papers for British Meeting

The following is a complete list of the papers to be presented at the autumn meeting of the British Iron and Steel institute, which will be held in Middlesbrough, Yorkshire, from Sept. 14 to 17:—

"Special Report No. 18: Reports Upon Blast-Furnace Field Tests. I—An Investigation of a Blast-Furnace Smelting, Principally Lincolnshire Ores, at the Frodingham Works of the Appleby-Frodingham Steel Co., Ltd.," by the Blast-Furnace Reactions Research Sub-Committee of the Iron and Steel Industrial Research Council; "Special Report No. 19: Foamed Blast-Furnace Slag," by T. W. Parker (being a report of the Slag Tests Panel to the Blast-Furnace Committee of the Iron and Steel Industrial Research Council); "Some Experiments in a Small-Scale Cupola," by H. E. Blayden, W. Noble and H. L. Riley; "The Influence of Carbonizing Conditions on Coke Properties. Part I—Mechanical Pressure," by H. E. Blayden, W. Noble and H. L. Riley.

"The Mechanism of Nitride-Hardening," by M. S. Fisher and Z. Shaw; "Hot Metal Practice in Five Melting Shops on the North-East Coast," by W. Geary; "The Thomas-Gilchrist Basic Process, 1879-1937," by Frank W. Harbord; "Variation in Thickness of the Tin Coating of Tinplate, and Its Effect on Porosity," by W. E. Hoare; "Some Alloys for Use at High Temperatures. Part IV—The Constitution of the Alloys of Nickel, Chromium and Iron," by C. H. M. Jenkins, E. H. Bucknall, C. R. Austin and G. A. Mellor; "Further Experiments on the Nitrogen-Hardening of High-Chromium and Austenitic Steels," by B. Jones; "A New Method for Judging the Behavior of Iron Ores During Reduction," by N. J. Klarding; "Some Notes on Recent Experiments in Connection with the Spraying of Steel by the Wire-Fed Metal-Spraying Pistol," by Richard R. Sillifant.

Milwaukee Chapter Will Meet

Activities of the Milwaukee Chapter of the American Foundrymen's association for the coming year will be launched with a large dinner meeting at the Schroeder hotel on Sept. 17, according to Walter Gerlinger, chairman. An active membership drive now is under way with encouraging results reported for the initial efforts. In this drive, the Milwaukee chapter will canvass all foundries in the state and urge foundry executives to induce apprentices to take an active interest in chapter affairs to obtain educational benefits and other features.

Committees appointed to direct activities of the chapter include the following: Program—B. D. Claffey, chairman; E. L. Roth, David Zuege, H. J. Held, A Passman, S. E. Shaver, K. Charlton, and Ralph Lee; publicity—George M. Pendergast, chairman; attendance — William Bornfleth, chairman; Leo Koenig, William Glade, V. C. Mekeel, Nels Anderson, Edward Meyer, A. H. Donald, and Oscar Barr; apprenticeship—Victor Hydar, chairman; L. Bartel, C. E. Silver, John Roth, John Brown, Adolph Schott and William Watson Jr.; social—Ralph Lee, chairman; George Dreher, George I. Gilson, A. C. Lange, J. H. Champion, Walter Underwood, Fred Grant, H. P. Kreulen;—membership—T. E. Ward, chairman; Oscar Patzke, Lawrence Andrae, Paul Rice, R. Anderson, C. W. Mueller, E. N. Carpenter and R. S. MacPherran.

A Short Talk on Molding Sand

(*Concluded from page* 31)

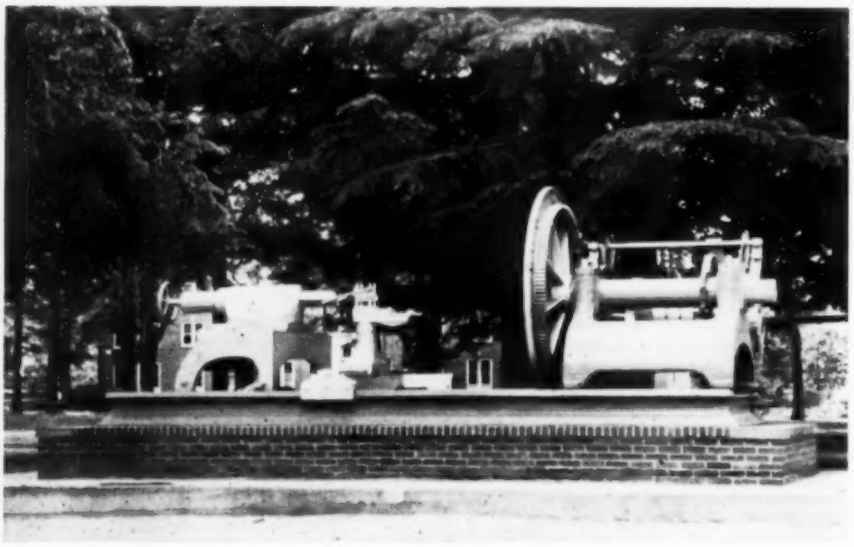
fects are dirt, drops, swells, and necessity to ram hard to secure a lift, frequently causing metal agitation and resulting in dirt seams and rat tails. Excess clay losses are associated with high moisture losses, resulting in a high dry strength and high shrinkage, causing mold wall fracture resulting in scabs.

Sand grain losses are of two types, coarse and fine. Coarse sand grains may cause rough surface and pin holes. Pin holes may result from high permeability, permitting hot gases rapidly to strike mechanically held water, causing explosive liberation of steam. Fine sand grains may cause insufficient permeability, resulting in metal agitation which picks up fines from the mold surface.

Mold hardness is probably one of the greatest casting defect causes; low hardness causing swells and high mold hardness causing rat tails and scabs. Molding equipment requires special attention to obtain proper mold hardness. The mold hardness is measured best by the hardness tester.

Flask equipment comes in for a large portion of the blame. Poorly vented flask equipment reduces mold permeability. Poorly barred flask equipment requires the molders to ram harder than necessary to prevent drops.

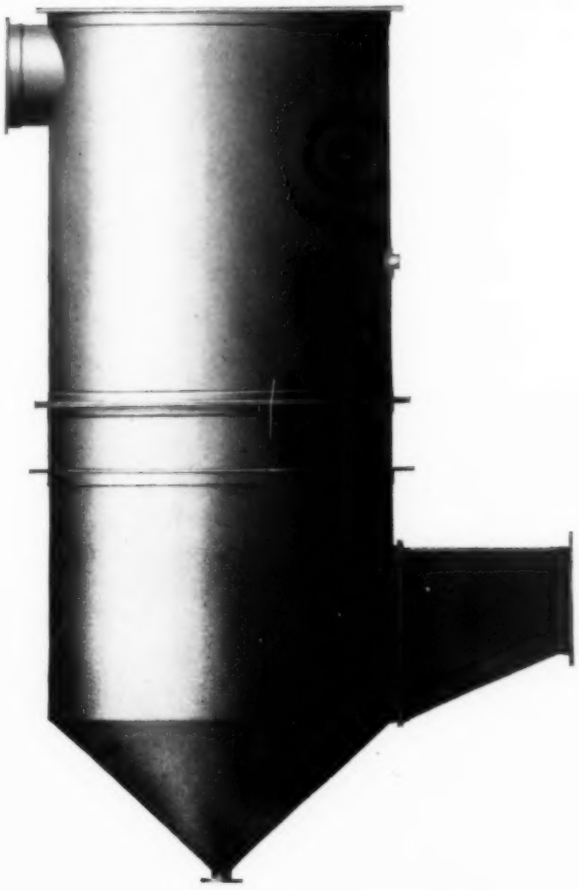
Lathe Is Monument on University Campus



MORE than 70 years old, but still in good condition, the lathe shown in the accompanying illustration was presented to the Alabama Polytechnic institute, Auburn, Ala., by the Tennessee Coal, Iron & Railroad Co. It occupies a place of honor as a monument, on the institute's campus. The lathe was used to bore cannons for the Confederate army at the gun works in Selma, Ala. Then for 50 years it was used to turn locomotive tires at the Linn Iron Works, Birmingham, which was dismantled in 1929.

Hobart Brothers Co., Hobart Square, Troy, O., has published a booklet entitled "The New Arc Welding Manual and Operator's Training Course." The 94-page book may be secured through that company for 50 cents.

The New SCHNEIBLE Junior MULTI-WASH DUST COLLECTOR



All Metal . . . No Wearing Parts . . . No Nozzles . . . No Dead Zones . . . Nothing to Burn, Clog, Freeze, Adjust or Maintain.

Investigate the

Schneible Junior Multi-Wash Dust Collector

—lowest in cost—highest in efficiency!

In keeping with the demands of the industry, Schneible engineers have developed and are offering the New Schneible Junior Multi-Wash Dust Collector—a modern, proved device, whose operation is based on the widely acclaimed Schneible Multi-Wash Method.

The Schneible Junior Multi-Wash Dust Collector is low in cost and features the same major advantages as the Senior Multi-Wash Collector—nothing to rapidly wear or break—no pockets or dead zones—no internal moving parts—no nozzles and spray tips—nothing to adjust or maintain—nothing to clog, freeze or become inoperative.

The Junior Collector consists of a lower cone section and an upper tower section providing an initial precipitation chamber, five scrubbings of the dirty air by the impingement plates and dewatering of the cleaned air by the entrainment separator. It's small, it's compact, it's highly efficient, and it's easy to install!

The same Dewatering Tanks and "Wear-Proof" Pumps as used in Senior Multi-Wash Systems complete the installation.

On installations of Schneible Junior Dust Collectors where higher operating efficiency is desired at a later date, an intermediate four-plate tower section is available which provides for converting the Junior Collector into a Senior Unit.

Schneible Junior Dust Collectors are made in all sizes for handling from 2,000 c.f.m. to 30,000 c.f.m. for suppressing dust, fumes and gases.

Send for descriptive bulletin on this new low cost Wet Method Collector today!

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Form Church Spire

(*Concluded from page* 33)

double-dipped hot galvanized structural steel shapes, and the assembly was partially made by riveting and welding before galvanizing. The unexposed steel work was given a standard protective coating of red lead. Final assembly in Versailles was made with galvanized steel bolts set in bitumastic paint.

The top section of the spire was made of four separately cast members of an aluminum-silicon alloy containing 5 per cent silicon (No. 43 alloy) assembled by bolts. The same alloy was used for the base and the belfry louvers. The latter were cast individually and later secured by aluminum-copper alloy head bolts.

The various sections of the base were bolted together by integrally cast flanges on the inside of the pieces. All the bolts in the spire, with the exception of those which secure the belfry louvers, are concealed. After the various sections of the base were bolted together, the exterior joints were peened and dressed flush with the exterior surface of the assembly and sandblasted in a unit.

The covering of the apex of the spire is held in place by special galvanized steel expansion anchors.

The design of the spiral units which travel from the belfry to the top was difficult to execute because the spiralling becomes narrower and thinner toward the top. Cap castings of an aluminum - magnesium alloy were used to cover the special joints in the vertical members which hold the spirals in place.

The cross was fashioned from rectangular tubing, 2 x 2½ inches, and finished by the alumilite process which provides the surface of the metal with an anodic oxide coating, extremely durable even though very thin.

The joints in the ornamental ring above the belfry were finished with peening and dressing tools. The ring is composed of four sections, bolted together with double-dipped hot galvanized steel bolts at four points on the circumference, through flanges cast integrally on the inner edges. The fluted ring just below the belfry was assembled in the same manner.

The steeple framework is practically invisible when seen from the street. The spire creates the illusion of leafiness, laciness, and crispness by reflection of the sun's rays.

Fig. 5—Close up of the belfry louvers and base ornaments Fig. 6—Typical concealed butt joints were used in base and belfry

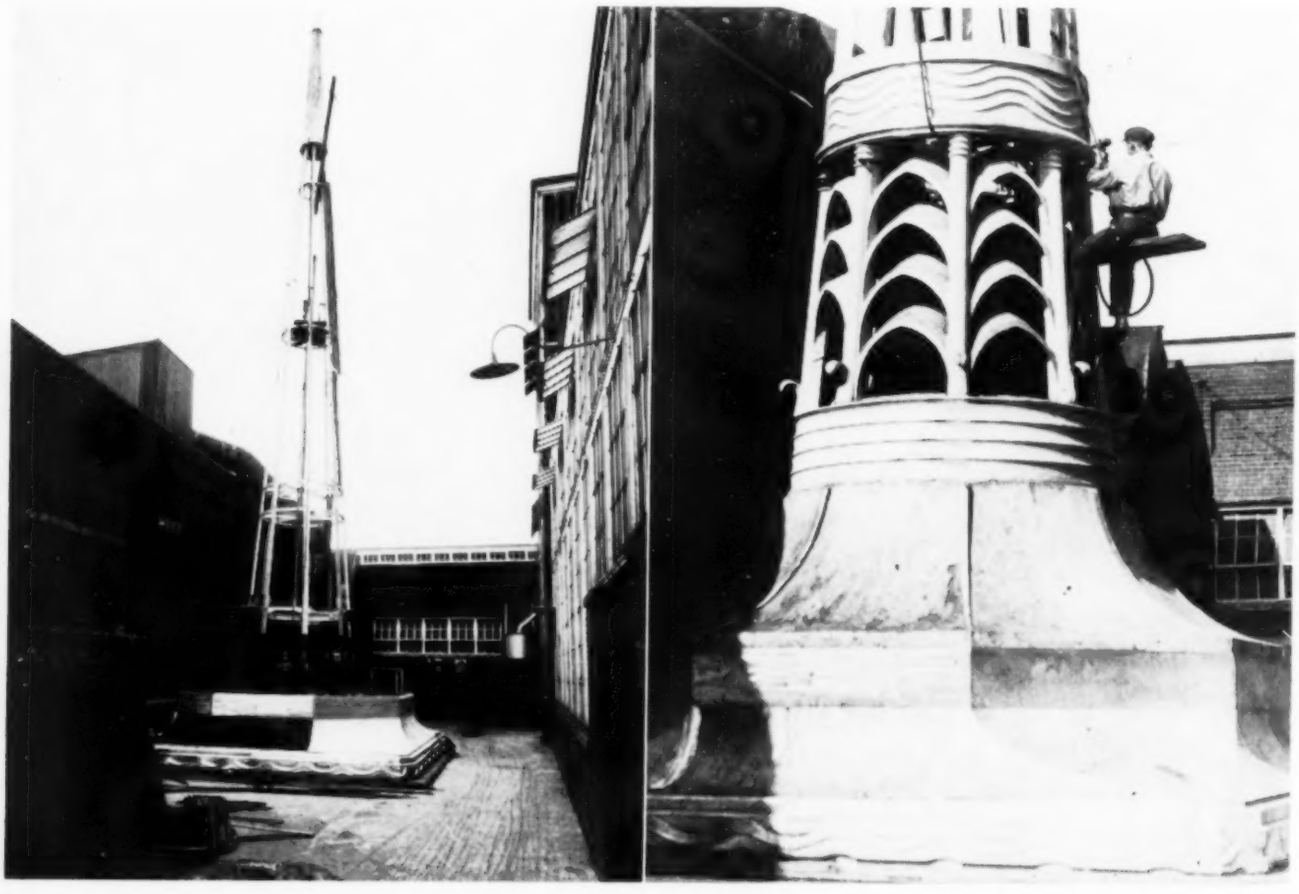

Fig. 3—Start of the spire. The supporting steelwork has been erected and the top section cast of No. 43 aluminum alloy has been placed in position. Spire gutter and lower part of base have been partially assembled. Fig. 4—Peening and dressing tools were used to finish the joints in the ornamental ring above the belfry

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Humidity Affects Cupola

(*Continued from page* 35)

better results. On the other hand, adding moisture by spraying water into the bed simply means that the thermal efficiency of the cupola is reduced, as this vapor robs the cupola of the amount of heat it carries out the top. However, the idea has been advanced that it speeds up the burning of C to CO_2

If this is true it simply means a lower bed could be used as the C will burn to CO_2 as the air travels through a shorter distance before all of its oxygen is used up. As far as increasing the amount of C to CO_2 per minute, moisture or a fast burning coke does not affect this as the amount of C to CO_2 per minute is fixed by the amount of O, delivered per minute by the air.

The secret of high combustion and thermal efficiency in the cupola lies in the amount of air used, with a minimum amount and, of course, with a minimum amount of coke.

Compensation for Air Moisture

Some places, however, coke is added and it is claimed that better results are secured. Calculations along the following line have been published in an effort to prove that extra coke should be added to compensate for moisture in the air.

When using 360,000 cubic feet of air containing 360 pounds of H_2O, equation (5) indicates that 1.5 pounds of H_2O will combine with one pound of C so that 360 ÷ 1.5 or 240 pounds of C or 266.66 pounds of coke apparently should be added per hour. Assuming 2000 pounds of iron per charge, an 8 to 1 ratio means 250 pounds of coke per ton or per charge. Twelve tons or 12 charges then means 266.66 ÷ 12 or 22.2 pounds of coke to be added per ton or per charge. The ratio would then be 2000 ÷ (250 + 22.2) or 7.2 to 1 instead of 8 to 1. However, if the story is continued perhaps the theory of adding coke to take care of the moisture in the air can be exploded.

A recently published article, advocating coke addition gave the above figures but did not go far enough. When the 240 pounds of C added combines with the 360 pounds of moisture according to equation (5) the result is as follows:

360 pounds H_2O + 240 pounds C = 40 pounds H_2 + 560 pounds CO − 1,416,000 B.t.u.

The moisture is used up with the 240 pounds of C but in using it up, 1,416,000 B.t.u. are absorbed so how would it be possible to get better results when the total heat available is reduced so much? However, the 40 pounds of H_2 and 560 pounds of CO cannot remain stable at the temperature prevailing in the bed and O_2 from the air present so that according to equation (6):

40 pounds H_2 + 320 pounds O = 360 pounds H_2O + 2,460,000 B.t.u.

This shows an improvement, as 2,460,000—1,416,000 shows a gain of 1,044,000 B.t.u. which should show better results but the 360 pounds

H. V. Crawford

H_2 is back again; also, 320 pounds of oxygen in the incoming air has been used. If the H_2 is going to burn why not also the 560 pounds of CO from equation (5)? This will be according to equation (4) as follows:

360 pounds O + 560 pounds CO = 880 pounds CO_2 + (240 × 10,200) B.t.u. = 880 pounds CO_2 + 2,448,000 B.t.u.

Consequently, 2,448,000 B.t.u. have been gained and adding this to the 1,044,000 gained from (5) and (6), the total gain is 3,492,000 B.t.u. However, 320 pounds of O_2 have been used up in equation (6) and 320 pounds in (4) or a total of 640 pounds of O_2 from the incoming air which according to equation (1) would give the following:

240 pounds C + 640 pounds O = 880 pounds CO_2 + 3,492,000 B.t.u.

Therefore, 240 pounds of C have been used up and this is just the same amount added to take care of the moisture. Equations (5), (6) and (4) in order, result in giving 360 pounds H_2O, 880 pounds CO_2 and + 3,492,000 B.t.u. whereas equation (1) alone gives 880 pounds CO_2 + 3,492,000 B.t.u. and nothing happens to the 360 pounds H_2O. If, therefore, 240 pounds of C are added 640 pounds of O must be added and either way of figuring shows a gain of 3,492,000 and more heat is available which may give better results —but certainly not due to adding 240 pounds of C to take care of the moisture. If the air is too high and 640 pounds of O in excess of that required is available, adding the 240 pounds of C is the correct procedure and the extra B.t.u. are gained and also this 640 pounds will not cause excessive oxidation of the iron.

If the air actually is supplied on the basis of 30,000 cubic feet per ton, it can be shown that there is an excess of at least 640 pounds of O, even with an 8 to 1 ratio, much less a 10 to 1 ratio. This means that, at least 240 pounds of C should be added and the ratio would be 7.2 to 1. With a ratio of 8 to 1 and 12 tons per hour and 90 per cent C in coke (12 × 2000) ÷ 8 gives 3000 pounds of coke and 0..90 × 3000 gives 2700 pounds of C. Only 65 per cent of this or 1775 pounds burns to CO_2 according to equation (1) as follows:

1755 pounds C + 4680.6 pounds O = 6435.6 pounds CO_2 + 25,535,250 B.t.u.

2700 − 1755 leaves 945 pounds C to combine with some of the CO_2 just formed above. This is according to equation (3) as follows:

945 pounds C + 3465.3 pounds CO_2 = 4410.3 pounds CO − 5,528,250,510

The B.t.u. available is then 25,535,250 − 5,528,250 or 20,007,000. The 4680.6 pounds O used in equation (1) is equivalent to 265,200 cubic feet of air per hour at 60 degrees Fahr. and 14.7 pounds per square inch barometric pressure and 12 × 30,000 or 360,000 cubic feet is supposed to be used. It previously has been shown that this will give 27,540 pounds of air and since 23.1 per cent is O_2, then 0.231 × 27,540 gives 6361.74 pounds of O or an excess of 6361.74 − 4680.6 or 1681.14. With 360 pounds of the 27,540 pounds of air being moisture, the O_2 will be (27,540 − 360) 0.231 or 6278.58 and the excess is 6278.58 − 4680.6 or 1597.98 pounds.

Too Much Air In Winter

Since only 640 pounds are required for the 240 pounds of C to be added the results will be better and in fact enough should be added to use up all of the 1597.98 pounds O in excess of that required. This reduces the ratio and the proper way is to cut the air so that there will be 1597.98 pounds of oxygen less or use only 265,000 cubic feet instead of 360,000, or 22,000 cubic feet per ton instead of 30,000 at 60 degrees Fahr. and 14.7 pounds per square inch.

In the winter when the temperature goes to 0 degrees Fahr. and below and the barometer is 15.2 pounds per square inch, 22,000 cubic feet will give 4200 cubic feet too much per ton or 50,400 cubic feet too much per hour or about 1050 pounds of excess oxygen. This is

compared to 1681.14 pounds excess at 30,000 cubic feet per ton at 60 degrees Fahr. and 14.7 pounds per square inch so that atmospheric conditions are exceedingly important, and if not taken into account more coke should be used to prevent excessive oxidation in the winter time.

In most cases enough coke is charged at all times to use up this excess and excessive oxidation does not take place. This is, of course, under low iron to coke ratios. In order to prevent excessive use of coke at times, the amount of coke should be varied and this is done in many cases. In any case, variations in coke used, varies the carbon pick up, and this with a variation in the oxygen used changing the silicon loss, is the reason the temperature, fluidity, and hardness of the iron over the spout will vary over a wide range. However, most of the blowers in service today are badly worn and the slippage of air or belt slippage or air leakage is so great that nothing like 30,000 cubic feet per ton is being used, otherwise ratios even as good as 8 to 1 could not be secured.

Should Reduce Coke

The previous discussion indicates that there is nothing to be gained by adding coke when there is moisture in the air. In fact, since moisture in the air actually means less oxygen, the coke really should be reduced, if the same balance between carbon and oxygen is to be maintained. In order to show just how much the coke should be reduced it will be necessary to use the correct amount of air without any moisture in the air and then add the moisture and calculate the amount the C should be reduced to balance the loss in O due to moisture in the air.

At a 10 to 1 ratio, 12 tons per hour, means 2160 pounds of C per hour and 75 per cent must burn to CO_2 in the bed and therefore 0.75 × 2160 gives 1620 pounds of C burned according to equation (1) as follows:

4320.54 pounds O + 1620 pounds C = 5940.54 pounds CO_2 + 23,571,000 B.t.u.

And 2160 − 1620 leaves 540 pounds C to combine with CO_2 according to equation (3)

1980.18 pounds CO_2 + 540 pounds C = 2520.18 pounds CO − 3,159,000 B.t.u.

Consequently 2160 × 1455 gives 31,482,000 B.t.u. if all of the C could be burned perfectly to CO_2. The combustion efficiency is therefore, (23,571,000 − 3,159,000) ÷ 31,428,000 or 65 per cent, instead of 48 per cent at a ratio of 7.2 to 1 when coke is added to a 8 to 1 ratio to compensate for moisture content.

The 4320.54 pounds of O used in equation (1) corresponds to 18,703 pounds of air or 245,000 cubic feet per hour at 60 degrees Fahr and 14.7 pounds per square inch barometric pressure.

If the air should contain 7 grains of moisture per cubic foot 245,000 × 7 would give 1,715,000 grains or 245 pounds of moisture in the 18,703 pounds of air. There would then be a shortage of 245 pounds of air or 56.6 pounds of O. Since it takes 2667 pounds of O to burn a pound of C to CO_2; 56.6 ÷ 2.667 gives 21.2 pounds of C or 23.5 pounds of coke total reduction per hour. This is equivalent to 23.5 ÷ 60 or 0.39 per minute or on the basis of each charge, 23.5 ÷ 12 or about 2 pounds per charge or 198 pounds instead of 200 pounds. It is not practical to keep the C constant within this limit so that it is impractical to consider reducing the coke to compensate for moisture, even on the most humid day.

If the coke is not reduced there will be a reduction in coke burned to CO_2 of 21.2 pounds and B.t.u. evolved will be reduced 21.2 × 14,550 or 308,460. This 21.2 pounds must then burn to CO and heat absorbed will be 21.2 × 5850 or 124,020 B.t.u. The heat available will then be reduced 308,460 + 124,020 or 432,480 B.t.u. Then instead of a total of 20,412,000 being available there will be 20,412,000—432,480 or 19,979,520 B.t.u. and the combustion efficiency is 19,979,524 ÷ 31,428,000 or 63.7 per cent instead of 65 per cent.

Increase Air Volume

Increasing the amount of air to compensate for moisture would of course be better than reducing the coke. Adding for 7 grains of moisture per cubic foot means 245 pounds of air must be added giving 18,948 pounds. This is equivalent to 248,500 cubic feet per hour or 20,708 cubic feet per ton instead of 20,417 cubic feet or 4142 cubic feet instead of 4083 or 59 cubic feet added per minute.

If 4033 cubic feet per minute are required at 10 to 1 and 12 tons per hour and 60 degrees Fahr. and 14.7 pounds per square inch pressure and no moisture, at 100 degrees Fahr. and 14.2 pounds per square inch pressure, the volume should be $\frac{560}{520}$ × 14.7 × 4083 or 4550 cubic feet $\frac{\quad}{14.2}$ without any moisture. With 7 grains per cubic foot, 4.5 pounds or 65 cubic feet should be added, making a total of 4615 cubic feet. This shows that for correction for temperature and pressure of the air 467 cubic feet of air should be added, whereas, under the most severe conditions only 65 cubic feet should be added to correct for moisture.

Why should the coke be reduced or the air increased to correct for moisture in the air as long as no effort is made to calculate or deliver the correct amount of air? On the basis of the old rule of thumb of 30,000 cubic feet of air per ton, 6000 cubic feet per minute would be required. This amount is to be compared with 4083 cubic feet at 60 degrees Fahr. and 14.7 pounds per square inch without moisture or 4142 cubic feet with moisture and 4550 cubic feet at 100 degrees Fahr. and 14.7 pounds per square inch, without moisture or 4615 cubic feet with moisture.

If coke is added under certain conditions and the results are improved, it is an indication that the air is too high in the first place and the proper procedure would be to reduce the air. Certainly if coke is added to compensate for moisture in the air and the results are improved, there is no question but what reducing the air would give even better results.

Moisture Unimportant Factor

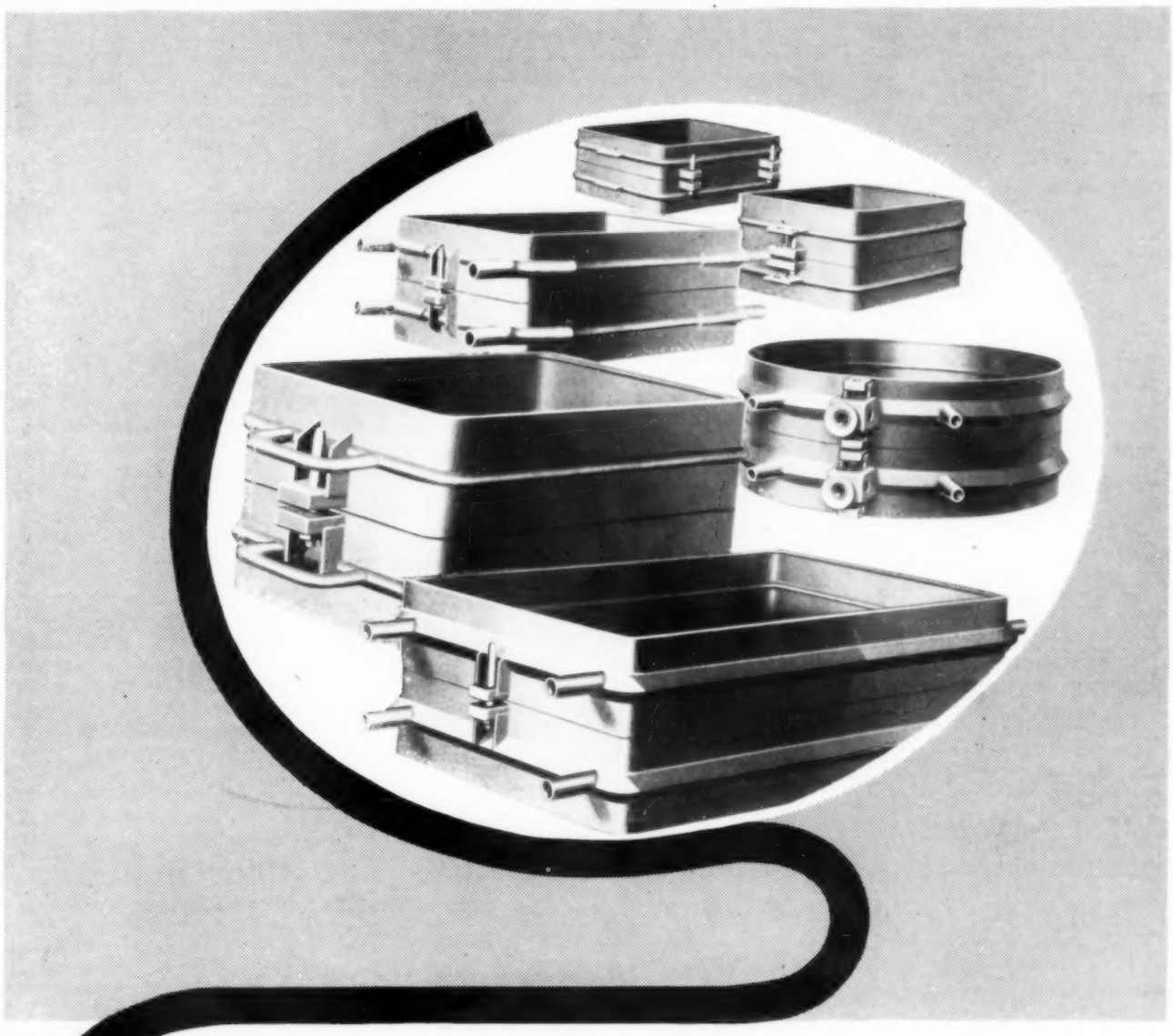
The proper method, however, is to figure the air properly in the first place and, since the moisture in the air has little effect on the B.t.u. available, reactions (4) (5) and (6) can be disregarded and the air calculated on the basis of all of the carbon burning according equations (1) and (3). Equation (2) does not change the results as any CO formed by the incoming oxygen will burn to CO_2 by (4) so that the results are the same as if that much C had burned directly to CO_2 by equation (1).

Air is used for only one purpose and that is to supply the oxygen necessary for combustion and since the weight of oxygen in a certain volume of atmospheric air will vary over a wide range due to variation in atmospheric temperature and pressure, the volume of air should be varied. The variation in the pounds of oxygen supplied by a constant volume of air is so great that the error due to moisture is a very, very minor consideration and practically nothing is to be gained in attempting to make correction for it; either by reducing the coke or the air. Certainly not by adding more coke, more air or more moisture.

Foreman Training

The American Foundrymen's association, Chicago, has published the papers and discussions presented at its Milwaukee convention on foremen and apprentice training in foundries. Those are bound together to form a 57-page pamphlet, and include four papers and two transcripts of conferences. Copies of the bulletin may be obtained from the association for $1.00 with a 50 per cent discount to all members.

PRODUCTION SPEEDERS



THEY NEVER LOSE THEIR ACCURACY

Do any typical job in any foundry with a Sterling Foundry Flask and note . . . how light it handles . . . how rigid and twist-free it is . . . how staunchly it resists jolting . . how accurate and level it is at the parting. Distortion-proof . . . flanges having full width bearing and solid center ribs provide double reinforcement. For Speed plus Accuracy,

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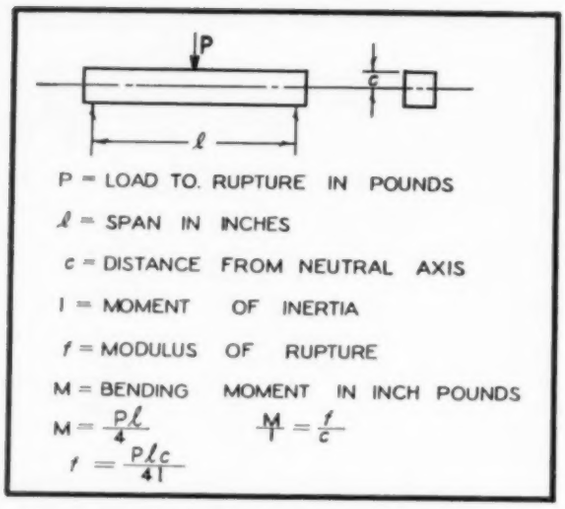


Fig. 8—Transverse test arrangement

Testing Cast Iron

(*Concluded from page* 37)

and has been adopted in this country as a basis for a working classification. Where tests are made correctly the results are reliable and comparable.

Assume we have a tensile diagram represented by OA in Fig. 6 in which the load and corresponding strain have been measured. A is the point of fracture. Assume also we have portion $OA'B'$ of the diagram for compression although this need not be continued to fracture. Make $OA'B' = OAB$ and find the center of gravity of both areas. Area OAB represents the total tensile force acting on the tension side at fracture while the area $OA'B'$ represents the total compressive force acting on the compressed side at fracture.

Let h = depth of bar
b = width of bar
Draw CC' representing average stresses on tension side

$$OC = \frac{\text{Area } OAB}{OB}$$

Let S_{av} = Stress OC = average stress on tension side.
M = bending moment on bar on transverse test in pound-inches
P = load to fracture in transverse test in pounds
l = length of span in inches

$$M = \frac{Pl}{4} = S_{av} \frac{OB}{BB'} \times h \times b \times \frac{d}{BB'} \times h$$

$$P = \frac{4\,S_{av}\,bh^2}{l} \times \frac{d \times OB}{(BB')^2}.$$

By such reasoning the load at fracture may be computed and related to the tensile test properties. The assumptions are reasonably true except insofar as skin stresses are concerned, and the method seems to tie together the transverse test which the foundryman uses in control and the tensile test which the engineer uses in design. That method is according to Bach *Elastigitat und Festigkeit, page* 301, who found good agreement between the load at fracture computed this way and the actual values from the transverse test.

The impact test is considered by the engineer to be arbitrary in character since the results cannot be applied directly to design work. As a control test for materials it has wide and useful range in the scheme of things.

There are two kinds of impact tests, one using notched bars and the other unnotched bars. The former is more widely used in testing work and the values obtained are expressed in foot pounds of energy to fracture in the case of the Izod type, and meter-kilograms, in the case of the Charpy type. This type of notched bar impact testing is again subdivided into single blow machines such as the above types and repeated blow machines such as the Krupp or Stanton types. In the repeated blow impact tests a record is obtained of the number of blows to fracture by a falling hammer which hits the test bars over the notch alternately at points 180 degrees apart. In the Krupp machine the hammer is 4.81 pounds and the number of blows are 84 per minute, the distance between test bar supports being 100 millimeters. Fig. 7 shows the same type but a different make of machine as used by National Physical laboratory, Teddington, England and Fig. 8 the repeated impact results obtained for correctly and incorrectly heat-treated boiler-plate steel by Stanton's method.

It is doubtful if the values obtained by the single blow test of cast iron are of any great value. For instance referring to the report of subcommittee A3 of the A. S. T. M. It can be seen that taking the extreme cases of the irons tested the tensile strength varied from 29,000 to 51,000 pounds per square inch but the single blow impact values only varied between 3.7 and 5.7 foot-pounds. The corresponding values for the repeated blow impact tests varied from between 3400 blows for the softer iron and 9000 blows for the harder iron. It is felt that the repeated blow test being spread over a longer time period and having a simpler notch is not subject to errors due to the slight notch variations which must play a controlling part in the results of the single blow test on such materials as cast iron.

Probably the repeated impact test can be used for discriminating between one iron and another with respect to total carbon, graphite size, phosphorus, or alloy additions. It seems that more work should be done on this form of testing. In Table II the variation of tensile strength with single blows and repeated blow impact values are recorded. These may indicate that the repeated blow test is a compromise which for laboratory work has certain advantages over the single blow test.

Table I

Modulus Varies With Composition

No.	Tensile Strength	Modulus of E (Elastic)	Total Carbon	Combined Carbon	Graphitic Carbon	Brinell Number
1	28.7	19.6	2.70	1.01	1.69	277
3	14.9	18	3.21	...	...	211
7	20..4	23.2	1.57	0.78	.79	156

Table II

Variations in Physical Properties

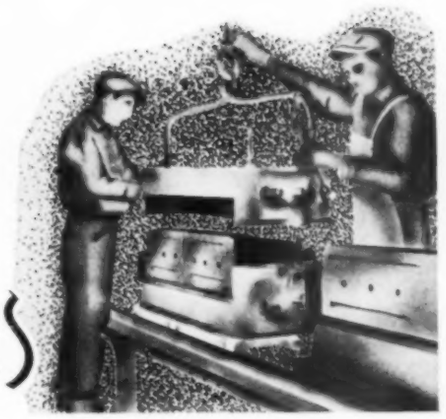
	Tensile Strength pounds per square inch	Single Blow Foot-pounds	Repeated Blow Number
A	29500	3.7	3400
B	28500	4.0	3700
C	18300	4.1	2200
D	21300	2.2	1110
E	32000	4.1	3300
F	22400	3.6	1030
G	30000	4.1	4600
H	31500	3.2	3150
I	20000	3.4	503
J	51500	5.7	8920

Establishes Office

Bunting Brass & Bronze Co., Toledo, O. has established a branch office at 1922½ Grand avenue, Kansas City, Mo.

ADVERTISING PAGES REMOVED

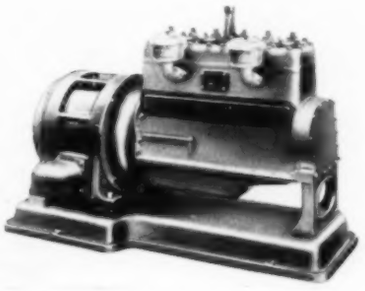
NEW EQUIPMENT for FOUNDRIES



Air Compressor

Schramm Inc., West Chester, Pa., has introduced a new compressor designed especially for installation in industrial plants. The compressor features include a new type of mechanical intake valve, located on the compressor block and operated from the camshaft in timing with piston travel. Main bearings intersperse every cylinder so that four cylinder models have five bearings and six cylinder models have seven bearings. Force feed lubrication is pumped under pressure to all main and connecting rod bearings, giving positive lubrication. Compressors are of the vertical, straightline, cylinder-in-line construction with water ports completely surrounding the entire cylinder area.

The compressor is made in sizes with air deliveries of 85, 105, 160, 210, 315 and 420 cubic feet actual air delivered per minute. Horsepower capacities range from 20 to 100.



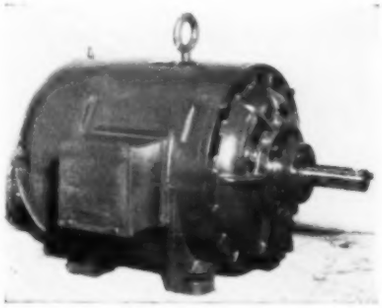
The features include a new type of intake valve

Bonding Mortar

Further improvement has been made in the refractories and working quality of Harwaco bond, a high temperature bonding mortar for industrial furnace masonry, according to its producer, the Harbison-Walker Refractories Co., Pittsburgh. The mortar has a pyrometric cone equivalent of cone 32 (3092 degrees Fahr.), and is a diaspore-base bonding mortar used for laying fireclay, superduty fireclay, and high alumina brick. It is said to remain uniformly soft and plastic throughout the steel drum or container in which it is shipped.

Motor Has Two Sets Of Air Ducts

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed a dual ventilated fan cooled type squirrel-cage motor which is protected against abrasive dust, moisture and corrosion. The motor frame consists of two separate sets of air ducts, one set internal and one set external. The internal ducts are open in the interior part of the motor and the external ducts are open on the outside of the motor frame. These two sets of ducts are separated by a common wall.



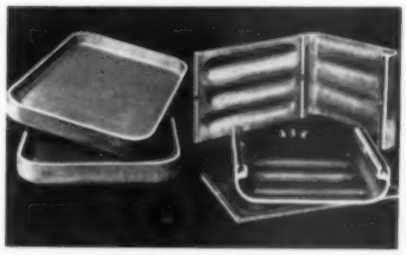
The heat exchanger principle is used for cooling

The heat exchanger principle is used for cooling. An internal fan on the rotor circulates warm internal air through the internal ducts, the walls of which are cooled by the external fan blowing larger volumes of cool air through the external ducts, providing rapid transfer of heat from the motor.

The housing is designed so that fresh grease enters the outside edge at the top of the bearing and excess or used grease is discharged at the bottom inner edge to the overflow sump.

Annealing Box

American Manganese Steel Co., Chicago Heights, Ill., is introducing a new sectional annealing box for use in carburizing, annealing and other heat treatment processes.



Annealing box is made in six separate parts which are fitted together by tongues and grooves

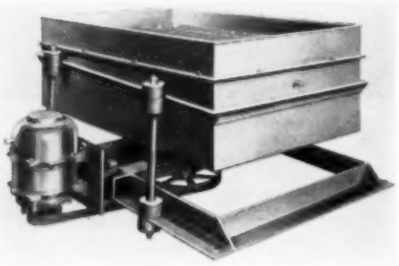
Greater operating efficiency is claimed for it. The box is made in six separate parts of heat and abrasion resistant alloy, as indicated in the accompanying illustration. The corrugated sides are tongued to fit into grooves in the corrugated ends, and may be keyed in place. The frame formed rests on a flanged bottom plate with legs for batch type furnaces, and has a flanged cover which fits over the box. A special type of annealing box is made with the bottom plate fitting and plates for use where the contents must be lifted with the box.

It is claimed that this type of annealing box does away with distortion or cracking brought about by alternate heating and cooling. Sufficient clearance is provided between tongue and groove to absorb expansion from heating and to allow contraction in cooling. With this new design, it is said there is no appreciable gas leakage at the joints. It is claimed that the new boxes are lighter than ordinary boxes and conse-

quently easier to handle. Should a section fail, it can be replaced easily and quickly at a fraction of the cost of an entire box.

Gyratory Screen

Beardsley & Piper Co., Chicago, has developed a gyratory screen which has rubber mounting and vibration dampeners on all supports. Two large heavy-duty rubber cushions are used to absorb vibrations at each of four positions on the screen and on the supporting structure, and it is claimed that no vibration is imparted to surrounding equipment or superstructure. The screen operates with a flat slope and is motivated by a revolving throw unit which imparts a constant reciprocating, gyratory motion.



Rubber mounting on gyratory screen absorbs vibrations

The screen is of stepped design to serve as a lump breaker, and made of extruded metal secured to the frame so that replacement is simple and easy. The screen is driven by a motor mounted on any of the four sides or below the frame, as desired. It is made in various sizes for different capacities, and in single or multiple deck types.

Rubber Wheels

Mathews Conveyer Co., Ellwood City, Pa., recently has developed a rubber-tired wheel shown in the accompanying illustration. Two types are available which differ only in that one is larger and heavier than the other. The wheels can be used for many different applications. When mounted in light frames, they form a conveying surface for fragile objects which must be protected from jarring or scratching. The sections are available straight or in any practical degree of curvature, with detachable or fixed couplings where portable or stationary conveyor sections are used.

Rubber-tired wheel has many applications

The wheels also can be used as casters for light dollies, small hand trucks, portable cabinets, etc. where a free running rubber-tired wheel is required. Wheels are of pressed steel construction with hardened steel inner and outer ball races. The small wheel is 2⅞-inches outside diameter and has a rated capacity of 20 pounds. The large wheel is 3½ inches in outside diameter, and has a rated capacity of 50 pounds. The rubber tire is steamed into place, and it is said that the tire contracts upon drying and fixes itself solidly on the wheel thus in effect producing a solid one piece unit.

Dome Reflector

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has designed an enclosed dome type reflector for 250-watt mercury lamps installed for industrial lighting applications where mounting heights of from 8 to 18 feet are encountered. The reflector consists of an 18-inch diameter porcelain enameled dome with various types of hood mountings and a dust tight hinged glass cover. The convex lens used in the cover is acid etched on the inside and smooth on the outside. The entire assembly provides a wide distribution of light and it is claimed the diffusing lens minimizes the glare from the lamp.

The reflector is designed for 250-watt mercury lamps

The reflector is drawn from 24 gage iron sheet. The glass cover is hinged directly to the reflector bead, supported at three points. A heavy waterproof felt provides a gasket between reflector and lens.

Pneumatic Rammers

Dayton Pneumatic Tool Co., Dayton, O., has developed two new pneumatic rammers for bench and floor molding. The valve unit used in the rammers is the reed type shown in the accompanying illustration, and employs a blade which operates with a side action in a vertical slot. The bench rammer has a piston diameter of 1 1/16-inches, a piston stroke of 4-inches, weighs 13½ pounds, has an air consumption of 14 cubic feet and is 21 inches long.

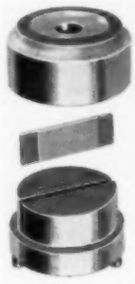


Fig. 1—Valve unit used in rammers is the reed type

Fig. 2—Bench rammer weighs 13½ pounds and is 21 inches long

The floor rammers have pistons of 1¼ and 1½ inches in diameter, with piston stroke of 6 inches. They weigh 21 and 28 pounds, have an air consumption of 20 and 24 cubic feet and are 50 and 51 inches long respectively.

Conveyor Roller

The accompanying illustration shows a newly developed roller which has been added to its standard line by the Mathews Conveyer Co., Ellwood City, Pa. The new roller incorporates 3½-inch outside diameter seamless steel tubing with a 5/16-

(*Concluded on page* 96)

TABOR

TRADE 1884 MARK

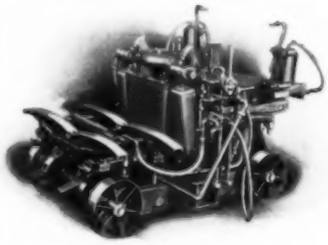
FOUNDRY MOLDING MACHINES

The Standard for Over Fifty Years

This complete line offers the right type machine for any molding need

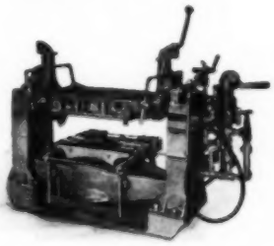
Column Jar Squeezer

Jar Flask-Lift Machine



Hinged Jar Rollover Pattern Draw Machine

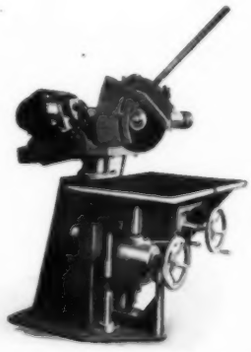
Jar Squeeze Flask-Lift Machine (Pintle Post)



Trunnion Jar Rollover Pattern Draw Machine

Plain Jarring Machine

- **SQUEEZERS . . JAR SQUEEZERS**
- **HINGED ROLLOVER MACHINES**
- **TRUNNION ROLLOVER MACHINES**
- **JAR FLASK-LIFT MACHINES**
- **JAR SQUEEZE FLASK-LIFT MACHINES**
- **PLAIN OR SHOCKLESS JARRING MACHINES**



TABOR-BRASIVE CUT-OFF MACHINE

It takes 2-inch risers off pure nickel in 12 seconds, and makes equivalent speeds on all other tough metals and alloys. It will save money for users in cutting tool steel, bakelite, wire cable, aircraft tubing, ferrous and non-ferrous castings, common or refractory brick, tile or slate, switchboard panels, marble slabs, limestone and sandstone, granite, concrete, etc. It can be furnished in several types to meet any cutting need.

THE TABOR MANUFACTURING COMPANY

6225 TACONY STREET, PHILADELPHIA, PENNSYLVANIA

(*Concluded from page 94*)

inch wall. The bearing is newly designed, having steel inner and outer labyrinth seals, hardened inner and outer ball races, and thirteen 9/16-inch diameter hardened steel balls,

New conveyor roller employs a hexagon axle to insure locking of inner ball race and axle

assembled within a pressed steel jacket. The assembled roller is said to have an average capacity of 2200 pounds.

A hexagon axle is applied in this roller, which is said to provide a positive means of locking the inner ball race and the axle, thereby preventing wear between those parts. The axle is drilled at the ends, and grease fittings applied, to make periodic lubrication a simple matter. Cotter keys hold the roller firmly in the frames. The roller can be supplied in lengths ranging from 6 up to 48 inches and can be spaced in the frames on centers ranging from 4 inches upward. Channel or angle frames generally are used in the construction of conveyors incorporating the roller. When the rollers are placed low in the structural frame, the top of the frame functions as a guard rail for the commodities being conveyed.

Tiering Truck Lifts Heavy Weights

Automatic Transportation Co., 101 West Eighty-seventh street, Chicago, has designed a large industrial tiering truck for handling 30 ton dies to and from the presses at various heights. Dual platform lift units are synchronized for equalized lifting by four two-part roller chains. A dual drum die handling unit is mounted on the platform. An eight wheel trailing axle fully equalized and compensating controlled by power steer is claimed to give finger tip control.

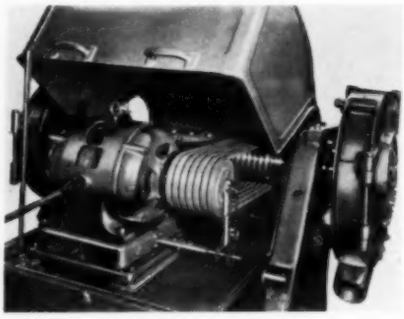
Electrode Holder

Tolman Mfg. Co., 19-21 West Third street, Boston, has introduced an electrode holder which is said to hold the electrode firmly or releases it promptly by a few turns of the handle, holding the electrode at an angle or in the straight position. The holder is claimed to be completely insulated.

Floor Grinder

Kling Bros. Engineering Works, Chicago, has introduced a new type grinder which embodies a wheel wear compensator. By turning a handle the wheel speed is regulated so that an approximate peripheral speed of 8500 surface feet per minute is maintained as the diameter of the wheel decreases through use. As a safety factor, a lever mechanism between the spark guards and the compensator, prevents high speeds with new wheels as the speed must be reduced before the guard can be raised to install a new wheel.

A handy pushbutton on the front of the base actuates a magnetic switch inside. As shown in the accompanying illustration the motor shaft is mounted in the same plane



As the grinding wheel wears down, rotation of the wheel can be increased to maintain the proper peripheral speed

as the wheel shaft to reduce vibration. The shaft is split for easy replacement of belts, and is held together securely by a heavy coupling. Variable pitch texrope sheaves with 7 belts is said to provide nonslip drive. Large supporting bearings close to wheel chucks are claimed to give maximum bearing life. A smooth streamlined exterior eliminates unnecessary angles for chip lodgement. A special work rest with pedal control is available for production grinding.

Arc Welder

A new 150-ampere alternating, transformer type arc welder has been added to its extensive line by the Wilson Welder & Metals Co. Inc., New York. This addition makes available welders in capacities of 150, 300, 500, 750 and 1000 amperes. It is claimed that all machines are complete and self contained units requiring no other accessories except welding cable, electrode holder and hand-shield.

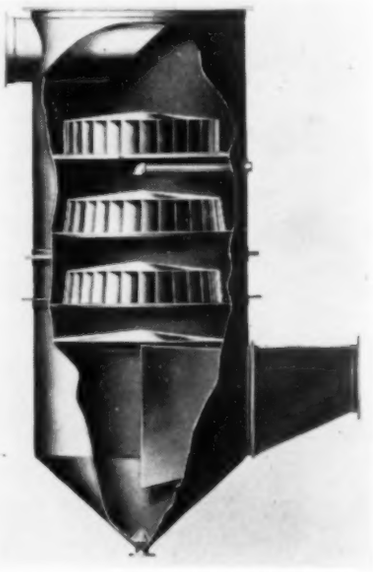
The line of welders has been redesigned recently, and each welder is said to be constructed especially for rough, hard shop usage. One of the features incorporated in the machine includes a system of three controls or adjustments of the welding current. The first two controls make it possible to obtain 25 coarse adjustments. The third control offers a further and finer adjustment of current values within any one of the previous 25.

Dust Collector

Claude B. Schneible Co., Chicago, has introduced a smaller size type of its multiple washing dust collecting unit in which the dirty air, gases or fumes are scrubbed 5 times instead of 13 as in the large unit. The small unit was designed for single function operations such as encountered with mold shakeout devices, sand mullers, pulverizers, crushers, spray booths, molding stations, sand conditioning units, etc.

In the unit the dust and fume burdened air is drawn into the bottom of the tower where the heavier particles are deposited in a sludge cone. The air is drawn upward through a turbulent water spray, passing over two sets of impingement plates which scrub the air. That is said to remove the remainder of the dust which is precipitated to the sludge cone at the bottom of the tower. The air is dewatered by an entrainment separator and discharged. Sludge in the cone is pumped to a multiple louver dewatering tank where the water is drawn off and recirculated.

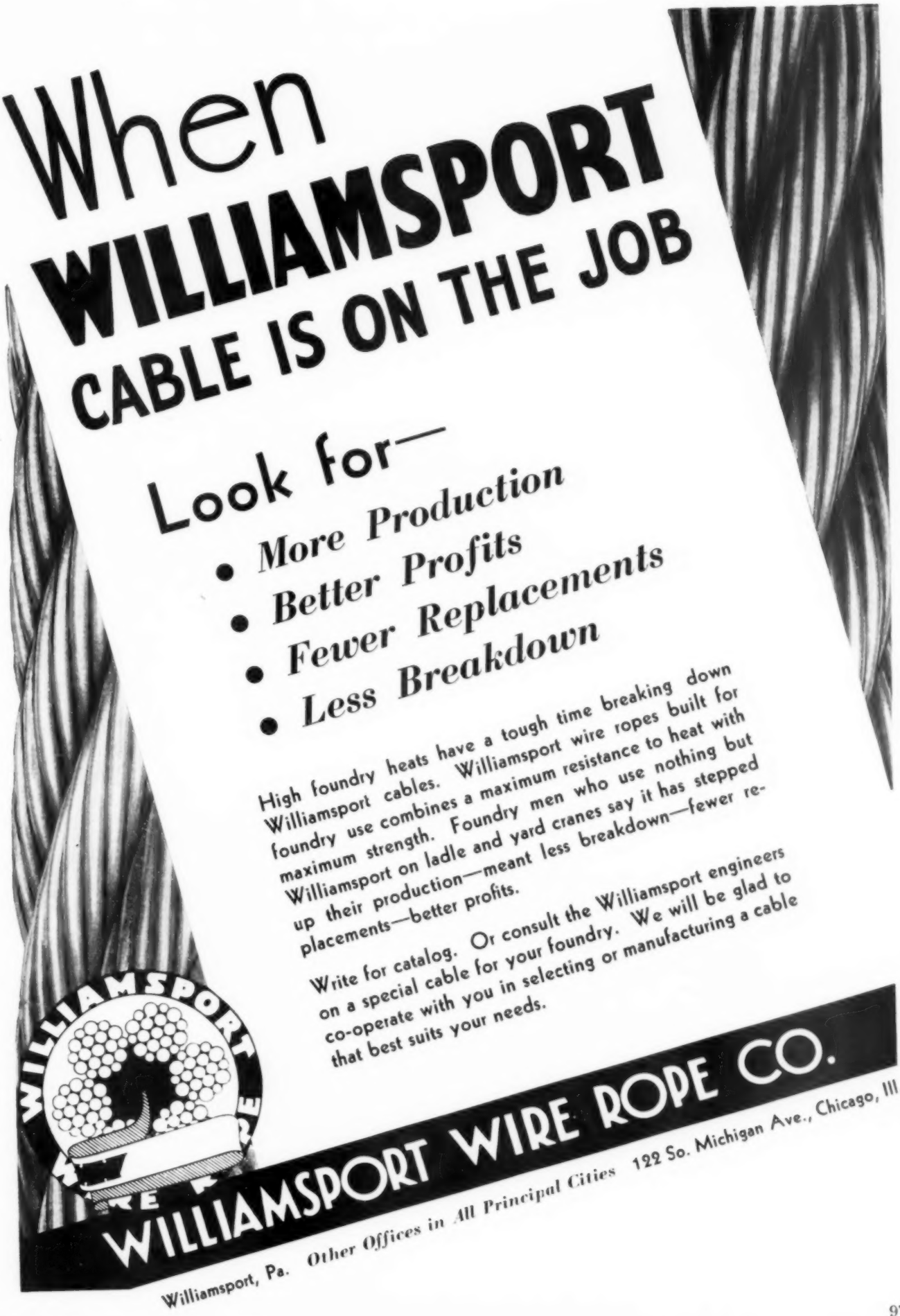
It is said that the small unit can be converted readily to the large size by inserting a single section



Sectional view of the small size dust collector unit showing the principal parts

containing additional impingement plates in the tower.

When WILLIAMSPORT CABLE IS ON THE JOB



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- *Fewer Replacements*
- *Less Breakdown*

High foundry heats have a tough time breaking down Williamsport cables. Williamsport wire ropes built for foundry use combines a maximum resistance to heat with maximum strength. Foundry men who use nothing but Williamsport on ladle and yard cranes say it has stepped up their production—meant less breakdown—fewer replacements—better profits.

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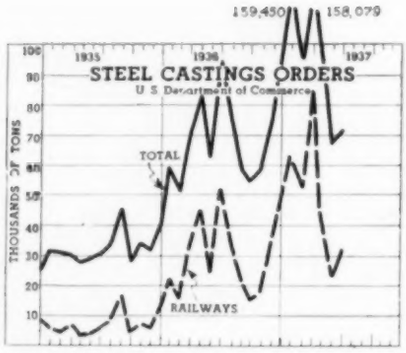
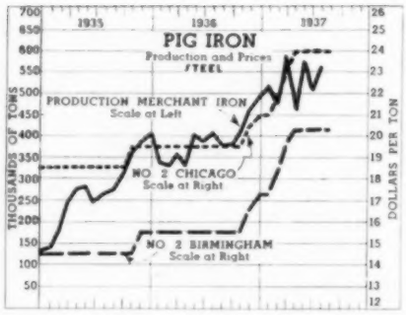
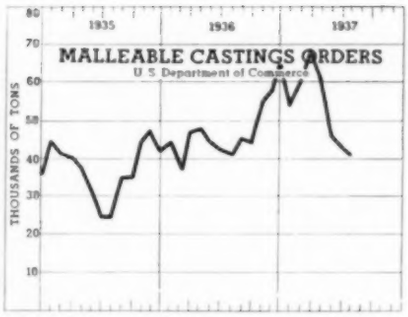






FOUNDRY ACTIVITIES

LINK BELT CO. is remodeling its Pershing Road foundry in Chicago to provide 40 per cent more floor area and to increase capacity to 1000 tons of castings per month. Work is expected to be completed Oct. 1. A new 2-story section extending the full length of the foundry will be devoted to bench and light machine molding. Additional space also will be provided by other extensions to the building. New mold storage machines and sand handling and conditioning equipment are being installed. A new roof over the entire foundry will provide 1200 linear feet of skylighting and will be equipped with 30 positive type ventilating fans.

* * *

Hagerstown Foundry & Machine Co., Hagerstown, Md. recently suffered a $10,000 loss by fire.

* * *

Newnam Foundry Co., South Main street, Kendallville, Ind. recently was damaged by fire.

* * *

Atlas Brass & Aluminum Co., West Springfield, Mass. has opened a new foundry building on Norman street. The new building is 35 x 60 feet, brick mill construction. It is equipped to make large castings, including parts of paper mill and textile machinery. A general jobbing business is done and the new move allows for business expansion. Paul Jalasky is proprietor.

* * *

Ford Motor Co., Dearborn, Mich. is reported contemplating a new foundry to be built in the vicinity of its new blast furnace.

* * *

Neenah Foundry Co., Neenah, Wis., makers of sewer castings and manhole covers, will build a 60 x 60 foot, 1-story addition to its foundry.

* * *

Industrial Bearing & Foundry Co., Maplewood, N. J. recently has been incorporated. Wolber N. Le Page is agent.

* * *

Sheboygan Foundry Co., Sheboygan, Wis. has awarded contract for construction of a shop addition, 40 x 80 feet, to Hugo Bunke.

* * *

Washington Iron Works, Seattle, has prepared plans for a proposed steel frame warehouse to be 117 x 80 feet.

* * *

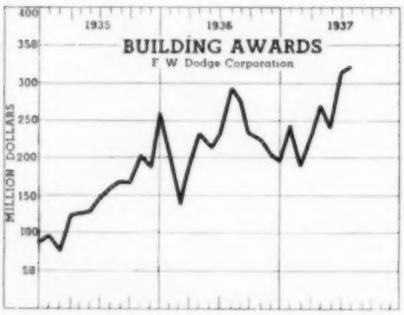
Production already has begun at the Columbia City division of Auburn Foundries Inc., Columbia City, Ind., which recently leased the idle Columbia foundry plant. The build-

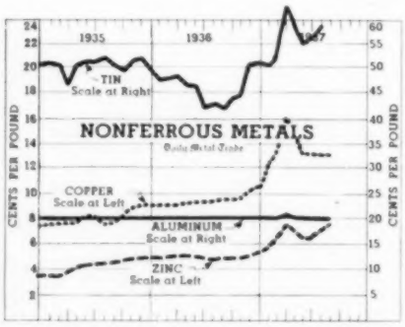
(*Continued on page* 100)

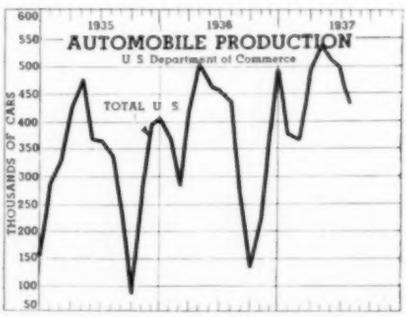
RAW MATERIAL PRICES

Sept. 2, 1937

Iron	
No. 2 foundry, Valley	$24.00
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	24.00
No. 2 foundry, Buffalo	24.00
Basic, Buffalo	23.00
Basic, Valley	23.50
Malleable, Chicago	24.00
Malleable, Buffalo	24.50
Charcoal iron, furnace	27.00
Coke	
Connellsville beehive premium	$ 6.00 to $ 6.50
Wise county beehive coke	5.50 to 6.50
Detroit by-product delivered	11.10
Scrap	
Heavy melting steel, Valley	$21.50 to $22.00
Heavy melting steel, Pitts. (dlv.)	22.00 to 22.50
Heavy melting steel, Chicago	18.50 to 19.00
Stove plate, Buffalo	15.50 to 16.50
Stove plate, Chicago	11.00 to 11.50
No. 1 cast, New York	16.00 to 16.25
No. 1 cast, mchy., Chicago	15.00 to 15.50
No. 1 cast, Pittsburgh	20.50 to 21.00
No. 1 cast, Philadelphia	21.00 to 21.50
No. 1 cast, Birmingham	15.50 to 16.00
Car wheels, iron, Pittsburgh	22.00 to 22.50
Car wheels, iron, Chicago	19.50 to 20.00
Railroad malleable, Chicago	20.00 to 20.50
Malleable, Buffalo	20.50 to 21.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	13.75
Straights tin	58.60
Aluminum, 99 per cent	20.00
Aluminum, No. 12 (Secondary, standard)	18.50
Lead, New York	6.50
Antimony, New York	15.75
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	7.25







Dumping Cupola Charges *promiscuously*

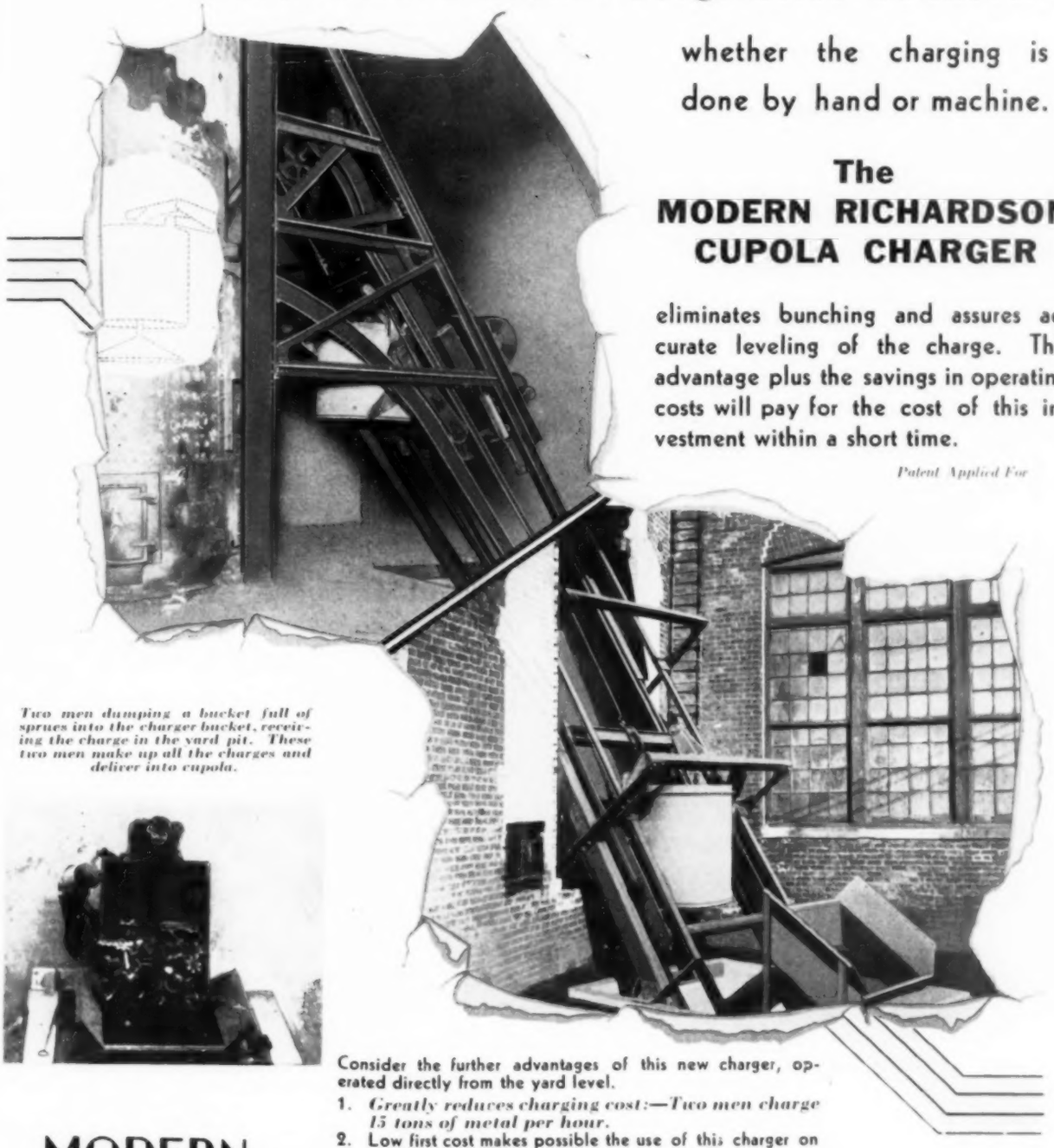
is entirely a matter of the past in *Progressive Foundries,*

whether the charging is done by hand or machine.

The MODERN RICHARDSON CUPOLA CHARGER

eliminates bunching and assures accurate leveling of the charge. This advantage plus the savings in operating costs will pay for the cost of this investment within a short time.

Patent Applied For



Two men dumping a bucket full of sprues into the charger bucket, receiving the charge in the yard pit. These two men make up all the charges and deliver into cupola.

Consider the further advantages of this new charger, operated directly from the yard level.

1. *Greatly reduces charging cost:—Two men charge 15 tons of metal per hour.*
2. Low first cost makes possible the use of this charger on small and large cupolas.
3. Can be installed without major building changes or a large amount of yard equipment.

For Complete Details Write

MODERN EQUIPMENT COMPANY

PORT WASHINGTON, WIS.

MODERN

Covered and Insulated Ladles
Lifetime Geared Ladles
Improved Bottom-Pour Ladles
Metal Pouring Systems
Crane and Monorail Systems for Metal and Mold Handling
Furnace Charging Cranes
Sand Conditioning Systems

MODERN EQUIPMENT CO.

(*Continued from page* 98)

ing is completely remodeled and new equipment installed. That equipment includes modern molding machines, electric lifting devices, overhead monorail system and sand-conditioners. W. S. Rowan is supervisor of both the Auburn and Columbia City, Ind. plants of the company. Burr O. Fink is president.

* * *

Index of foundry equipment orders for July, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 204.0 as compared with 228.2 for June and 159.6 for July, 1936. Index of shipments was 216.5 as compared with 232.1 for June and 145.7 for July of the previous year.

* * *

Allis-Chalmers Mfg. Co., Milwaukee, has undertaken a program of expansion and improvement of existing plants, including foundry facilities. It is estimated that from $6,000,000 to $8,000,000 will be spent on that work during the remainder of this year and in 1938.

* * *

Sandusky Foundry & Machine Co., Sandusky O., which just recently made an addition to its foundry, is building an addition to its machine shop to cost approximately $60,000. Total cost of improvements will be about $100,000, it is claimed.

* * *

Hoban Brass Foundry Co., Dayton, O., which recently had its plant destroyed by fire, is erecting a new building on Patterson boulevard. John Hoban is manager.

* * *

Spring City Foundry Co., Waukesha, Wis., is building a new core room and pattern storage addition. W. J. Grede, 6432 West State street, Milwaukee, is president.

* * *

Viking Pump Co., Cedar Falls, Iowa, is planning construction of a 1-story, 32 x 96 foot pattern shop addition. Contract has been awarded to George Pepin of Cedar Falls.

* * *

Brillion Iron Works Inc., Brillion, Wis., has started work on a foundry addition, 60 x 135 feet, to house a core room. A. F. Paustian is president.

* * *

American Locomotive Co., North Jay street, Schenectady, N. Y. is planning construction of a foundry on Front street. Cost will be approximately $40,000.

* * *

Bucyrus Castings Co., which has occupied the north end plant of the Ohio Steel Castings Co., has moved to new quarters in the old New York Central railroad repair shops.

* * *

Electric Alloy Foundry Co. Inc. recently has been organized at 3001 Navigation boulevard, Houston, Tex., to produce alloy steel and iron castings. The new concern is under the direction of J. V. Reich.

* * *

Van Brunt Mfg. Co., Horicon, Wis., makers of farm implements, is building a gray iron foundry extension, 81 x 100 feet, to cost approximately $30,000. Capacity is expected to be increased about 20 per cent. F. H. Clauson is president.

* * *

Nordberg Mfg. Co., Milwaukee, has re-equipped and reopened its brass foundry which has been idle nearly 10 years. New furnaces, an electric crane and other electric equipment have been installed.

* * *

Activity of gray iron and steel foundries in the Philadelphia Federal Reserve district declined during July, according to reports received by the Industrial Research department of the University of Pennsylvania. Production of gray iron castings, although showing a decrease of 12 per cent under that of the previous month, still was 7

(*Concluded on page* 102)

ELECTRICALLY BUTT WELDED FLASK WALLS RESIST GRUFLLING TESTS OF STRENGTH

Severe pulling tests on electrically butt welded sections of Truscon Foundry Flasks have proved the joints to be stronger than the estimated strength of the steel from which the shells are made. ● Combining the advantages of great strength and light weight, Truscon Alloy Steel Foundry Flasks are a real asset in any foundry. ● Before you place your next order for flasks, check up on Truscon Alloy Steel Foundry Flasks! Your particular requirements for size, shape and weight can be met promptly and accurately. Write for FREE catalog explaining all details.

TRUSCON STEEL COMPANY • FOUNDRY FLASK DIVISION
6100 TRUSCON AVENUE • CLEVELAND, OHIO

TRUSCON
ALLOY STEEL FOUNDRY FLASKS

A SAVING OF 42% IN MOLDING COSTS—*AND MORE*

In a Mid-West foundry a number of Rex Leakproof Apron Conveyors were installed in the sand handling system. The result was a 42% saving in the cost of molding plus a saving of 35% in floor space, 11% in cleaning cost, and 2% in metal. And they operated 4 years without one cent for repairs or replacements.

The Rex outboard rollers and equalizing saddles relieve chain and pan alike from the weaving, tearing action of eccentric loads. This Rex construction makes these conveyors leakproof and maintains them so. They are today an important part of many money-saving Rex Foundry Systems.

In these days of stress production and rising costs, a Rex Foundry Sand Handling System may answer both your problems. It costs nothing to investigate. See the Rex man or write for information *now*. Main office address—1671 West Bruce Street, Milwaukee, Wisconsin.

REX FOUNDRY EQUIPMENT

Rex-Stearns Timken Idlers

Rex Mold Cars

Rex Apron Conveyors

Rex Foundry Type Self-Cleaning Bucket

REX

CHAIN BELT COMPANY
of MILWAUKEE

Chain and Belt Conveying

(*Concluded from Page* 100)

per cent above that of July 1936. Output of steel castings showed a decline of only 7 per cent under that of June.

* * *

International Nickel Co., Inc., 15 Oak street, Bayonne, N. J., is planning to build a storage building and additions to its laboratory and foundry on Hobart avenue at a cost of $100,000.

* * *

National Bearing Metals Corp., Pittsburgh, has opened a new bronze foundry located in the Clearing district of Chicago. This plant is equipped to manufacture steel mill bearings, bushings, sticks and types of miscellaneous bronze castings. The new plant known as the Clearing division is under the direction of Wm. E. Cartwright, vice president, and William W. Murray has been appointed manager. Sales are in charge of H. A. White sales manager, Pittsburgh district.

* * *

Buckeye Steel Castings Co., Columbus, O. has purchased an 18-acre tract of land, adjoining its present plant. The property may be used for expansion purposes at some later date.

* * *

Gardner-Denver Co., Quincy, Ill., is constructing an addition to its branch foundry in La Grange, Mo.

* * *

Harnischfeger Corp., Milwaukee, recently has remodeled its Hercules Steel Castings plant into a modern electrode factory.

* * *

Renown Stove Co., Owosso, Mich., recently has added foundry equipment to double the capacity of its foundry.

* * *

Los Angeles Steel Casting Co., 2444 South Alameda street, Los Angeles, is erecting an office building at a cost of $2000.

* * *

Rogers Iron Works Co., Eleventh street and Pearl avenue, Joplin, Mo., recently started construction of a 35 x 50 foot addition to its foundry. Ozark Engineering Co. was awarded general contract.

* * *

McKinnon Industries, St. Catherines, Ont., makers of metal products for Canadian General Motors Co., has awarded contract to Smith Brothers Co., St. Catherines, for construction of a large plant addition.

* * *

Kinsley Foundry & Mfg. Co., Kinsley, Kans. has moved into the Blue Jupiter building, Dodge City, Kans. Construction of a foundry building nearby to be operated in connection with the machine shop, has been begun. Andy Shore is owner.

* * *

American Car & Foundry Co. plant at Madison, Ill., which has been closed for 7 years, now is operating at full blast. The plant probably will employ 1000 men as production is stepped up, according to E. E. Eagle, plant manager.

* * *

Ben Sibbitt Iron & Foundry Co., 217 Moore street, Wichita, Kans., one of Wichita's oldest and largest industrial institutions, has been purchased from Mrs. Clara Sibbitt, widow of the founder and acting president and general manager, by E. A. Watkins, vice president of the Union National Bank of Wichita. Mrs. Sibbitt will retire from general management but the business policies inaugurated by the late Ben Sibbitt will continue and as the business expands, new and additional equipment will be added, it is stated.

CORE MAKING economies follow quickly when you use durable lightweight core plates! They provide the savings that come with long, efficient service . . . the increased production that comes with easier handling.

Made of a specially treated combination of asbestos and cement, J-M Transite Core Plates are inherently durable . . . offer maximum resistance to cracking and breaking . . . are permanently free from corrosion . . . and there is little, if any, warping.

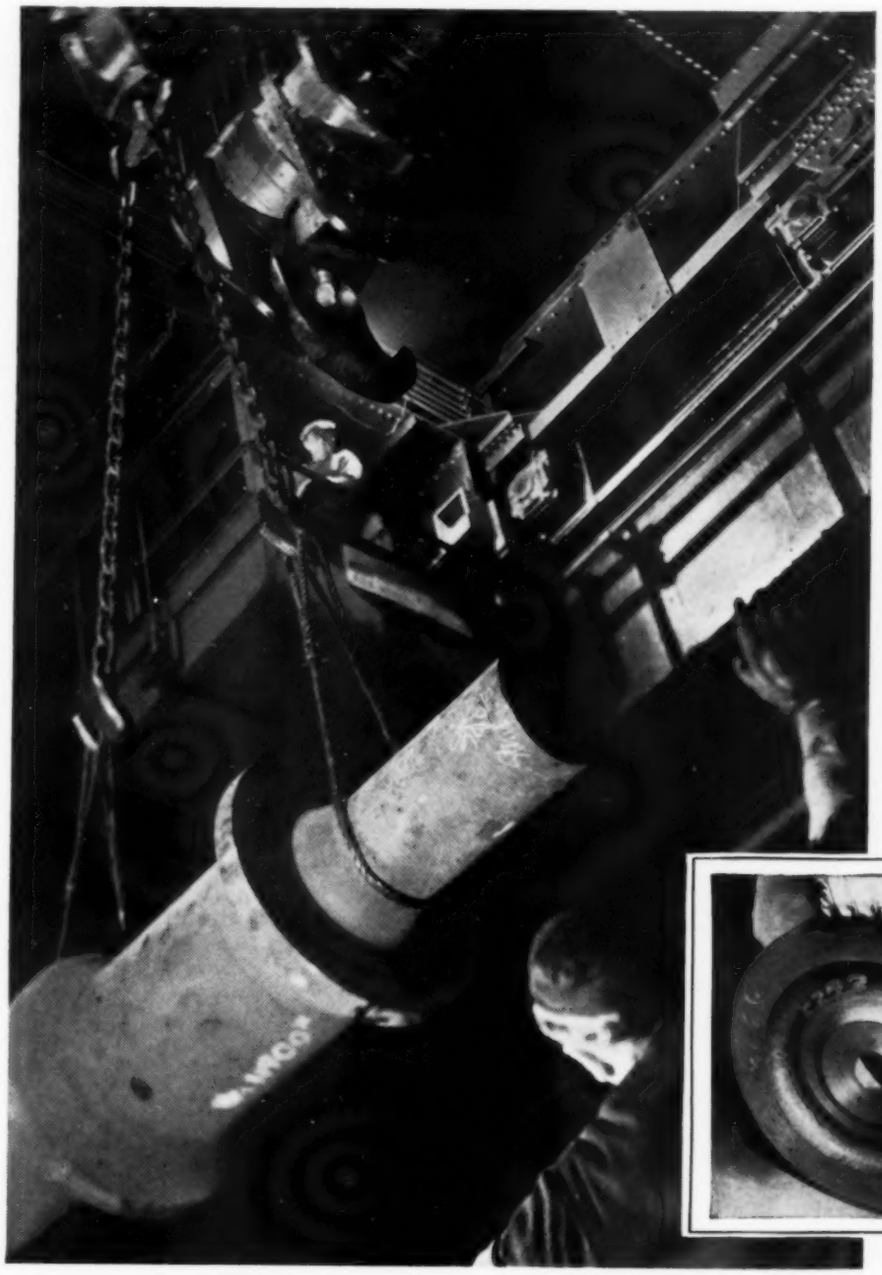
Yet, this is only half the story on Transite's contribution to lower core making costs . . .

Equally important is the fact that Transite Core Plates weigh only about a quarter as much as metal of equal thickness. Core makers actually carry ***twice as many*** with considerably less effort! Result . . . up goes production capacity . . . down go core making costs. For complete details, send for our free brochure. Write Johns-Manville, 22 E. 40th Street, New York City.

Johns-Manville
TRANSITE CORE PLATES
JM

"Wheel Holidays"

cost you Money here!



"WHEEL Holidays" occur when the machine shop closes down for crane wheel maintenance. Keep them to a minimum, and you avoid needless interruptions in the flow of work. You speed up shipments. Your men work full days and full weeks. You conserve profits.

Machine-shop superintendents have found that they can cut "Wheel Holidays" to less than half by using USS Wrought Steel "Rim-toughened" Crane Wheels. These wheels are built especially for long mileage. They outwear ordinary wheels by approximately 2½ to 1. You'll find them standard equipment on the largest, best-known cranes in the country. Specify them both for new equipment and for replacements. You'll appreciate the results.

USS Wrought Steel Crane Wheels, double flange or single flange, are furnished rough machined, finish machined, or finish machined with finish bore and keyway—rim-toughened or untreated, as desired.

Look for the letters "R.T.", stamped on the rim. They mean "Rim-toughened" by the USS process to assure lasting hardness, safety, and long wear.

U·S·S WROUGHT STEEL CRANE WHEELS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

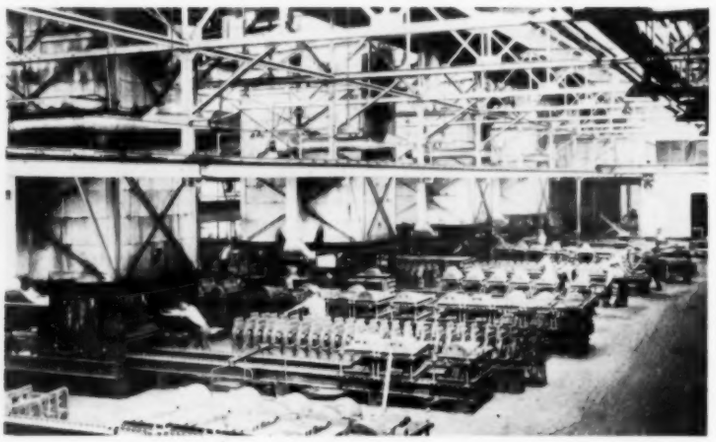
NEW TRADE PUBLICATIONS

Copies of any of the literature listed below may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

INGOTS—Ajax Metal Co., Frankford avenue and Richmond street, Philadelphia, recently has issued an interesting booklet on its 7-point ingots. Pages 7, 8 and 9 of the booklet contain the latest A. S. T. M. specifications (B30-36) for copper-base alloys in ingot form for sand castings, which can be used for permanent reference. Other pages explain the reason for the reputation for high quality which the product has won and interesting mention is made of the company's standard and proprietary ingots, golden glow yellow brass and alloys for fluxing, deoxidizing and hardening.

DSM

Vertical Ovens



View showing a battery of the Vertical Core Ovens.

IN 1929 The Caterpillar Tractor Company installed a battery of vertical core baking ovens for processing cores ranging in size from a few ounces up to over 200 lbs. each.

They later added paste and black wash drying ovens of the vertical type.

Now, after eight years experience with that equipment they have just completed another D.S.M. vertical oven installation for processing cores up to 930 lbs. each. And completing the job in a period of 4 hrs. 35 minutes from load to unload stations.

DETROIT SHEET METAL WORKS

DETROIT - - MICHIGAN

1270 Oakman Boulevard

VALVES—Galland - Henning Mfg. Co., Milwaukee, has issued a folder on its line of pressure sealed, leak proof valves. Jolt squeeze, hydraulic, shutoff and three and four-way valves are pictured and described.

INDUSTRIAL DESIGNS—Harold Van Doren & Associates, 1217 Madison avenue, Toledo, recently has published a folder describing their services and listing a number of clients in a variety of fields who have applied modern styling to their products.

REFRACTORY CEMENTS—Carborundum Co., refractory division, Perth Amboy, N. J., recently has published a descriptive pamphlet on its line of frax refractory cements. A resume of the properties and uses of the various cements is given in a concise manner.

STEELS—Ludlum Steel Co., Watervliet, N. Y., has published a 142-page booklet containing detailed information on its various types of steels. Data is given on compositions, forging, annealing, hardening and quenching temperatures, applications, etc.

PLATFORMS—The many types of skid platforms that may be used in conveying materials, goods, merchandise, parts and products by the lift truck method of transportation, are illustrated in a new colored folder No. 146 recently issued by Lewis-Shepard Co., 175 Walnut street, Watertown, Mass.

NICKEL CAST IRON—International Nickel Co., New York, has issued a 15-page bulletin entitled "Heat Treatment Fundamentals of Nickel Cast Iron, Plain Cast Iron, Nickel-Chromium Cast Iron and Nickel-Chromium-Molybdenum Cast Iron." All phases of heat treatment of the various types are covered.

CUPOLA CHARGER—The advantages to be found in the use of its skip type of cupola charger and in formation required for such an installation are contained in a recent pamphlet of the Modern Equipment Co., Port Washington, Wis. Other of the company's metal pouring devices including an insulated cylindrical mixing ladle are shown.

AIR COMPRESSORS — Worthington Pump & Machinery Corp., Harrison, N. J., has published a condensed catalog on its line of vertical compressors. The bulletin contains sectional views of important features of construction, detailed specifications of the feather-type valves and other principal elements, rating tables and dimension tables.

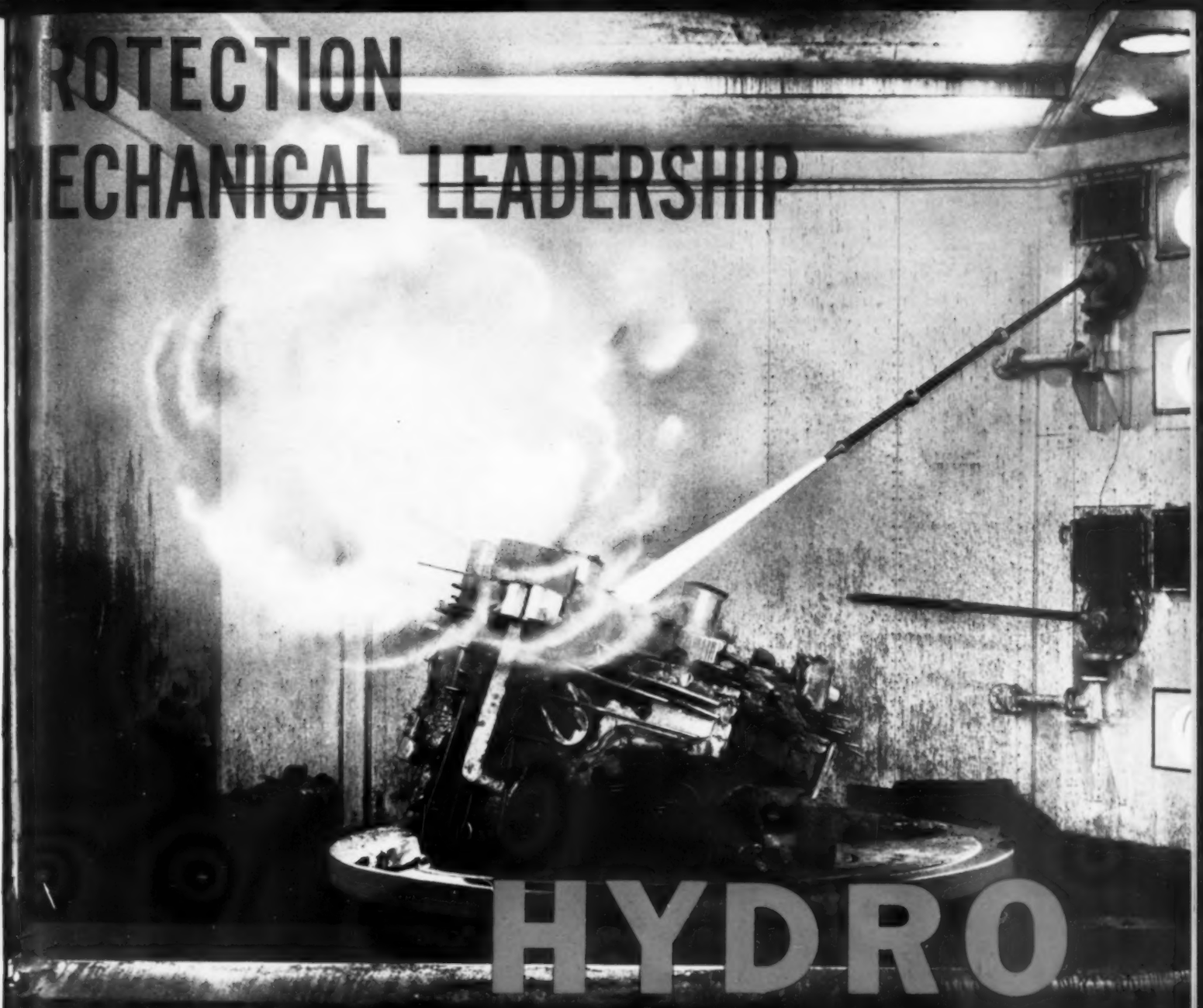
MONEL METAL—International Nickel Co. Inc., New York, has published three new bulletins dealing with the advantages of using monel metal for pump repairing, for valves and for gaskets. The wear resistant features of the metal as well as the facts and data on its improved properties are discussed in detail.

SLIDE RULE—An ingenious slide rule indicator for use in selecting the proper instruments for any application has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This slide rule shows at a glance what instruments to use, their range, approximate price, size and descriptive material available.

GAS MASKS—Mine Safety Appliances Co., Braddock, Thomas and Meade streets, Pittsburgh, has published a new bulletin describing its all-service gas mask for protectioin against asphyxiation from poisonous gases, fumes and smoke. The bulletin is well-illustrated. The outstanding features of the mask are explained in detail.

METALLOGRAPHIC EQUIPMENT — Adolph I. Buehler, Chicago, has published a bulletin entitled "The New Metal

(*Concluded on page* 106)



CORE-KNOCKOUT BLAST

MANY INSTALLATIONS MADE IN PAST SEVEN YEARS

As a dust preventative alone the Pangborn hydraulic method of cleaning castings is well worth its cost. Keeps the Foundry free from dust. Thoroughly removes cores from fillets and pockets. Core rods removed without sledges and bars . . . without bending and distortion . . . ready for reuse.

Removes large cores in few minutes. Its operation is quick, clean, economical and convenient. We have an interesting collection of cost studies, showing figures for various sized castings, ready to send you, upon request. Well worth writing for.

PANGBORN CORPORATION **HAGERSTOWN, MARYLAND**

World's Largest Manufacturer of Blast Cleaning and Dust Control Equipment

PANGBORN

(*Concluded from page* 104)

Analyst," which describes various types of the firm's metallographic equipment including cutting-off machines for specimens, bakelite presses, grinders, polishers, holders, and metallographic microscopes.

INSULATING CONCRETE — Quigley Co., New York, has published a folder giving information on the physical, insulating and refractory properties, and uses of its insulating, refractory, lightweight concrete which is called "Insulcrete." Applications include furnace linings, doors, shapes, covers, combustion chambers, etc.

CLEANING—Hydro-Blast Corp., 111 West Washington street, Chicago, has issued a bulletin on its wet sand cleaning method. The publication shows installations, operation, and gives engineering data on the savings involved in the applicatioin of the process. Time studies on the cleaning of various types of castings are shown.

BEARING BRONZE—Scientific Alloys Inc., Los Angeles, Calif., has published a folder describing a metallic process-alloy for use in the production of high-lead bronzes for bearings. The alloy and process is termned "Cataloy," and the amounts used range from 2 to 8 per cent in copper base alloys containing from 13 to 40 per cent lead.

WELDERS—"The Arc-Welding of Tomorrow" is the title of the bulletin recently released by the Harnischfeger Corp., Milwaukee. This booklet, No. W10, explains the advantages of an internally stabilized arc and photographs illustrate the uses of the various models of arc welders. Stationary and portable-trailer welders are shown and a cutaway view is used to show the design.

STEEL CASTINGS—Farrell-Cheek Steel Co., Sandusky, O., recently has issued a folder containing several bulletins describing its products. One describes the various steels produced with information on physical properties. Another indicates the various types of castings made while others give data on the firm's crane wheels, elevating and conveying buckets, rollers, cast tooth gears, and stoker and conveyor screws.

INDUSTRIAL ROOFING — Cutting maintenance costs on industrial roofing and siding is discussed in the new 12-page brochure, published by Johns-Manville, 22 East Fortieth street, New York. Application of that product is explained and amplified by numerous drawings showing construction details. Also illustrated are the company's special accessories for sealing the joints and ridges. Some typical installations are shown and dimensions and weights given.

MOLDING SAND — Taggart & Co. Philadelphia, has issued a booklet on the characteristics and properties of its special molding sand. The text describes the physical characteristics, such as moisture, strength and permeability. Colloidal properties, fineness, description of sand grains, a study of the clay substance, longevity and sintering properties of the sand, expansion and contraction, its deformation and resilience and its practical application, also are included.

HANDLING EQUIPMENT—An attractive cover introduces the general catalog for 1937-38 of the Duriron Co. Inc., Dayton, O., of equipment made exclusively for handling corrosive solutions. The text treats the chemical and physical properties, design, applications and advantages of various corrosioin resisting alloys, pumps, valves, circulating steam jets, pipe and fittings, mixing nozzles and miscellaneous corrosioin resistant industrial equipment. The catalog is well illustrated and in many cases dimensions and specifications for the equipment are given.

PATTERN LUMBER—Western Pine association, Yeon building, Portland, Oreg., recently has published an attractive booklet "Sugar Pine for Perfect Patterns." The booklet is well-illustrated with unusual examples of sugar pine patterns for Boulder Dam, Fort Peck Dam, the U. S. Engineers Sea-Going Hopper Dredge Goethals and numerous other examples of industrial uses in Pacific Coast foundries. The text covers a discussion of sugar pine grades commonly selected for patterns, refers to sizes and quality and points out important considerations regarding the proper seasoning of sugar pine at the mill and care of the stock in the pattern shop.

TUMBLING EQUIPMENT — American Foundry Equipment Co., Mishawaka, Ind., recently has issued booklet No. 211 on its wheelabrator tumblast, airless abrasive blasting equipment. The first part of the booklet contains a short history of the wheelabrator, its features and advantages, and engineering surveys of various installations. Features of operation and construction, illustrated and described in detail, are included, as well as photographs of some typical installations. The latter portion of the book gives information on the products cleaned by the unit, general assembly of the various sizes, data on other types of equipment including cabinets, dust collectors, core machines, sand cutters, etc., and a list of users of the equipment manufactured by the firm.

Top Hats for Iron Horses

Just another instance of the universality of application of abrasive grinding wheels. These steam pressure domes for locomotives are being spot ground with Abrasive Company Grinding Wheels on high-speed portable grinders.

Wherever metal is to be removed . . . parts precision ground . . . or edges sharpened . . . for production as well as maintenance . . . Abrasive Company Grinding Wheels will deliver maximum performance at minimum cost.

ABRASIVE COMPANY

Tacony and Fraley Streets • Philadelphia, Pa.

DIVISION OF SIMONDS SAW AND STEEL CO.

TRADE ABRASIVE MARK REG. U.S. PAT. OFF.